Ad Lectorem.

When Age, and Art, and Induſtry beſide,
Doth all invite, Experience being guide:
Then who will ſay; but ſurely this may bee,
A piece of Work exact from dotage free.

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T. F.

THE GVNNERS GLASSE.

VVherein the diligent Practicioner may see his Defects, and may from point to point Reforme and amend all Errours that are commonly Incident to unskilfull Gunners.

Set forth by way of a Dialogue:

BETWEENE

An Experienced GUNNER and a SCHOLLER,

with Tables of *RANDONS.*

Approved by the Authors own Practice, with certain easie wayes and Rules for taking of Distances: Never before this time Published.

WHEREUNTO

Is annexed part of the Excellent worke,

Published in *Spanish* by DIAGO UFFANO,

Containing a Dialogue between an Experienced *Captaine*, and a new Generall of the *Artillery*.

Shewing the Office and Duty of all Officers belonging to the Traine of the Artillery, with the manner of Batteries and Sieges, and many other things now Discovered for the benefit and good of the Common-wealth.

By WILLIAM ELDRED, *sometimes Mr. Gunner of* Dover-*Castle.*

Sold.
4° E. 22
Art

LONDON,
Printed by T. FORCET for ROBERT BOYDEL, and are to be sold at his shop in the *Bulwark* neere the *Tower*, 1646.

BIBLIOTHECA BODLEIANA

TO

THE RIGHT HONOURABLE,

ROBERT

Earle of WARWICK, Baron of LEES, &c.

Lord high Admirall for *King* and *Parliament*, one of his Maj: ties moſt Hon: privie Councell, and his Majeſties Lieutenant of *Norfolke*, and *Eſſex*, &c.

RIGHT HON: ble,

HAving ſpent the moſt part of my time in the Caſtle of Dover, being about 60 yeares in the place of a Gunner; in which time I have diligently obſerved many experiments in the practice of the Great Ordnance in that place from time to time, and alſo having likewiſe obſerved the skill, knowledge, and Condition of thoſe Gunners in that

place, with whom J have lived, and had my Converſation, J began to ſtudy with all diligence, how J might bring this worthy Art of Ordnance into a method, for an incouragement to the ingenious, who are by all tyes bound to advance the good of their Country and friends that are carefull to approve themſelves Gunners, in which Worke of mine J have diligently obſerved the Plat-formes, the quality of the Peeces, the Marks and Diſtances which J have ſhot, and how theſe ſhot fell, and having carefully noted the ſame in a Booke, from yeare to yeare, for the ſpace of this Thirty yeares and more. J conceive it fit to be Publiſhed, whereby my Country may be benefited, and the induſtrious Profeſſor of this moſt neceſſary knowledge, ought to be cheriſhed in the ſame. Among which J have found ſome carefull to approve themſelves Gunners and ſerviceable; but many other careleſſe and negligent, which proceeds J conceive through want of good Inſtruction, and therefore to give a cleerer light to theſe things, J have brought this Worke to view, and have intituled it, The Gunners-Glaſſe; in which J conceive, every man may ſee his defects, and amend the ſame; all which J offer to your moſt Honourable good Lordſhip, having had no little experience of the great Care your Lordſhip hath had over the Cinque-Ports, J humbly

crave

crave that your Lordſhip would be pleaſed to protect the ſame, and accept the ſervice of your aged Orator, who layeth downe his Life and this his labour at the feet of your good Lordſhip, with his hearty prayers to GOD for your Honour, in all health and happineſſe.

(***)

Your Honours,

ever to be Commanded,

WILLIAM ELDRED.

TO THE WORSHIPFULL, AND worthy Captaines, Gentlemen, Souldiers, and Gunners, that love the Art Military and are desirous of knowledge; W. E. the Auther of this Worke, wisheth all Happinesse.

HOnourable and curteous Gentlemen, That shall read this following Discourse, I know not into whose hands this may come, but I am sure if it do light into the hands of noble and generous Spirits, it will in some sort be well accepted, and my endeavour be favourably conceived.

To you therefore that wish well to Military exercises, I doe here adresse my Speech, desiring you to consider the scope and meaning of this my labour, being done to the end that I might in some sort help the understanding of the diligent Practitioner in the Art of great Ordnance, how requisit a thing this is in these dayes let all men judge.

Now I having spent a great part of my time in the Practice of this Art, and taking great paines in the same in the time of Q. *Elizabeth*, K. *James*, and their now Successour King *Charles* in that his chiefest Fort in the Cinque-ports, I thought it not only fit but also my duty to impart to my studious Countrymen, the fruit and effect of this my pains; because I doubt not but it may be profitable in these dayes both to KING and PARLIAMENT, and having seene and observed

ſerved the wonderfull ignorance of many profeſſors of the Gunners Art, I began to conſider whether this neglect do riſe from the Gunners or the Commanders, and I find the fault to be in both, in the Commanders becauſe either they do not or know not how to exerciſe the Gunners under their charge and Command, and the idle lazineſſe in the Gunners, that had rather ſpend their time in potting and canning, then in the knowledge of their Peeces or practice of their profeſſion, for which they receive their means therefore I could wiſh all thoſe that are Captaines or Commanders of Caſtles or Forts, to conſider what company of Gunners they are allowed: and if there be no Maſter Gunner, let him choſe out the moſt active and faithfull, and make him the Mr. Gunner to Command and direct all the reſt, and if you think good commit the Powder and all ſuch things as belongeth to the Ordnance into his hands, and let him give you account once a moneth of all the ſhot that hath been made in that time, under his hand writing, that is to ſay, from what Mount, with what Peeces, and upon what occaſion, and what Powder every ſeverall Peece did ſpend; alſo the mark that they ſhot at, the allowance in degrees or inches, that every ſeverall Peece had, and how it fell with the mark, gone or ſhort; thoſe things you that are Commanders ſhould require at the hands of a Mr. Gunner, which will be an occaſion not only for him to expreſſe himſelf, but alſo to ſtirre up the reſt of thoſe Gunners to be carefull to perform their ſervice, conſidering that their doings ſhall be examined once a moneth, and they examined before the Governour or Commander, and by this courſe, though you as yet be unacquainted in the practice of great Ordnance, yet in time you may grow very expert in practice of the ſame, and yet you ſhall not much trouble your ſelf

about it, but yet I wiſh you to keep in a book all thoſe notes that your Mr. Gunner doth deliver unto you, which may not only be a meanes to augment your reputation, but may be alſo profitable for the Common-wealth.

And now conſider I pray you what a moſt excellent thing it were if account were kept of all the Powder that have been ſpent in all the Forts in *England*, but in one yeere, which by this courſe might eaſily be done, if every Mr. Gunner make account to his Captain or Superiour, how theſe things have been performed, namely what Powder hath been ſpent, for what cauſe, from what Mount or Plat-form, in what Peeces, to what mark, and at what diſtance; what allowance he gave his Peeces in degrees or inches, and how the ſhot did fall, either gone or ſhort; and theſe things may well be required at the hands of any Mr. Gunner that ſhall in his conceit be able to take charge in ſuch a place, and this courſe will in time make good and perfect Gunners, and keep them in obedience, and diligent care in their places of ſervice, the particulars whereof, I have at large ſet down in the following diſcourſe of this book.

Note this.

Now for the Gunners that ſhall be imployed in this ſervice, to you I adreſſe my ſpeech, and do wiſh that all thoſe that will take upon them this commendable profeſſion, to conſider what he taketh in hand, that is to ſerve God, his King and Country, in all faithfull and true obedience, and to give all diligence to receive inſtruction, to which end, take theſe directions following.

First, let every Gunner that hath the charge of Ordnance upon any Mount or Platform, if it be not already named, to name the ſame, and all the Peeces upon that Mount, whether they be Falcon, Saker, Demi-Culvering, or whole Culvering, ſetting numbers upon the knob of the Carnous

A ſpeciall direction to be followed

at

at the breech with a hard Cheſil, that they may ever continue; when that you have done this, ſee what Peeces they be, whether Falcon or Saker, or any other; then make you a note book, wherein after you have ſet down the number and names of your ſaid Peeces, then take exactly the height of the bore which is called the Caliber, then the length of the Peece, the height of the Baſe-Ring, the height at the muſſel-Ring, and the thickneſſe of the mettal in the Chamber, which is called the fortification, all this with divers other you may ſee more at large deſcribed in this book, to which I do referre you, and do wiſh you to make you a Table of all theſe things, as you may ſee more at large deſcribed in this book, to which I refer you, and do wiſh all thoſe that ever meane to be Gunners, to be carefull and diligent in the practice and uſe of the ſaid Tables, which being once well and exactly done, may alwayes remain to many ages without any more adoe, and now let all diligent practitioners in this Art conſider what a benefit to the Gunner and profit to the Kingdome may inſue by this courſe of thoſe that are imployed about the ſervice of the great Ordnance, if they would but take a little paynes in following this courſe, and by this meanes there cannot be a queſtion demanded or propounded, but may ſuddainly and truly be anſwered by a diſcreet and wiſe Gunner, as you may ſee hereafter in the book.

But to conſider the nature and diſpoſition of moſt men in theſe times, I do much wonder that they be not aſhamed to be accounted Gunners, and to ſerve 4 or 5 yeere in a Gunners place, and yet continue ſo ignorant, as I my ſelfe have asked ſome of them of the moſt bragging ſort, (a vice that thoſe are given to that are moſt ignorant) what Peeces did you ſhoot ſuch a day? 2 Sakers and 3 Demi-Culverings, how do you know the Sakers or the Demi-Culverings

verings, the Gunners told me ſo, to what mark, why we ſhot at no mark, what is the height of a Saker. I cannot tell, what is the length of the Peece, what is her diſpart, how fortifyed in the Chamber, how much Powder, what is the length and bredth of the Ladle? I cannot tell; are not theſe queſtions poore things to be unknown of a Gunner that hath ſerved 5 or 6 yeeres in a Fort, and cannot anſwer ſuch pertinent queſtions as theſe, which are as needfull for a Gunner, as for a child that muſt learne to read, is to know his letters; but I have heard ſome of theſe ſay and make great brags what excellent ſhot they have made neere the mark, but queſtioning them further, they could neither name the mark, nor what allowance they gave the Peece, nor the diſtance to the mark, without the which knowledge, I ſay it is impoſſible ever to make a good ſhot, except it be by chance, as the blind man hit the Crow.

But let every man that will be a Gunner, know that he muſt firſt obſerve theſe three things, *viz.* To know his Peece, and ſecondly her execution, and thirdly the diſtance to the mark; in theſe three things depends the whole Art and profeſſion of a man that will take upon him the charge of a Gunner, and the one of theſe cannot be without the other; for firſt, if a man doth not know his Peeces, whether Saker or Demi-Culvering, &c. *viz.* Her height, her length, her ſtrength or fortification, her defects, what Powder ſhe may beare, and the diſpart, the perfection or imperfection of her Founding: with many other things belonging to a Peece, how can he ground any other rule for her ſhooting or execution, then for her execution or the diſtance how farre ſhe will carry, and this is a thing which by my long continued experience I have found out and practiced, as you may ſee at large

This I have experimentally proved being the chief occaſion of this booke.

large in this book, and without this knowledg *viz.* How farre a Peece will carry levell, or at the Mount of a degree, it is never possible to make a good shot, though he should shoot never so often; the next thing that I have to propound in this book, is to know the distance to the mark, which I have discovered at large, and set down as many wayes as is needfull for this Art.

This must necessarily follow.

And now my good friends which are desirous of this knowledge, what remayneth, but that you bend your minds to the study and practice of the same, for here is nothing propounded that is hard to be attained, no Arithmeticall questions, or Geometricall demonstrations but even a plain unlearned man may practice and use with little paines and study, and therefore you that are already placed in Gunners places, or do seek for such places, be exhorted to take paynes, be about your Peeces, measure them, see the faults and defects both in the Peeces and the Carriages, and look into your Peeces, see if they be free from flawes or hony-combs, eeven bored, and well conditioned in every part, also that your Platformes be kept neat and handsom, not overgrown with weeds and other things, as though there were no men in the Fort; also when 3 or 4 of you are together, go to some of your Peeces, take your Ladle and Spunge, and practice to load a Peece in jest without Powder, observing the word or direction, as you may see set down in this book to that purpose, and by this meanes you shall be expert in handling your Ladle and Spunge, whereby you may be fit to load a Peece before a Prince or great Commander with credit and reputation both of your Captain and your self, I do assure you, I have seen this thing much respected and observed in many places both in *Fraunce* and *Germany*, where I have travelled, and the Gunner for his comely handling of his Peece both commended and

The first and chiefest thing in a Gunner is to know his Peece.

See Pag: 41.

ſewarded, the courſe and ordering of theſe things, I refer you to the reading of this Book, wherein as I ſaid before, there is nothing difficult or hard, if you will but take the paynes to meaſure your Peeces, and make your Tables according to thoſe directions, which being once done, may alway continue; and therefore be not idle but induſtrious in your calling and profeſſion, and to which you have ſworn both to King and Parliament, moſt faithfully to performe; and therefore having in this book ſo eaſie a way layd before you, it were a great ſhame if any of you ſhould be found careleſſe and negligent in this your calling and profeſſion, and your Captaines and Commanders well worthy of blame to ſuffer ſuch negligence in his Fort, eſpecially among his Gunners that take charge of the Ordnance, being the principall ſtrength of a Fort.

And therefore I could wiſh all you that are Governours and Commanders of Caſtles, or of Forts, in the firſt place to conſider your Gunner, of what diſpoſition hee be, as well towards God as faithfull towards his Commander and Country, for it is moſt certain, that a man that feares God cannot be diſloyall to his Prince or Commander; make ſuch a man your Mr. Gunner, eſpecially if he have any learning or qualities to undergoe the ſame, let him take charge of the Powder and all other things belonging to the Ordnance, and let all the other Gunners be ruled and directed by him touching the ordering and mannaging their Peeces, and let him take account of all the ſhot as I ſaid before, of all the ſhot once a moneth, from what Mount, what Peeces, to what marke, upon what occaſion; what Powder every ſeverall Peece did ſpend, and how the ſhot did fall, either over or ſhort, and let your Mr. Gunner deliver the ſame unto you in writing once a moneth, whereby you may take occaſion to

in-

incourage the induſtrious, and to admoniſh the ſlothfull; and by taking this courſe, you may make good Gunners, as well for the ſervice and imployment you have for them in your own Fort, but may be able to do any other ſervice for the King and Parliament, whenſoever they ſhall be called thereto.

And as I have counſelled you to ſee that you have good Gunners, ſo I do deſire you to cheriſh and incourage thoſe that you find faithfull and diligent in obſerving the rules before preſcribed, and the directions ſpecifyed in this book, for the incouragement and countenancing of your Mr. Gunner, and thoſe that are diligent under him, is of great effect to profit young beginners, and this I have known by mine own Experience, that that man that endeavoureth to be conformable and moſt diligent, ſhall be moſt hated and diſpiſed amongſt the idle company, but you that are Governours and Commanders, do know how to order thoſe things in wiſdome.

But one thing makes me much marvell that ſo much care and paines is taken in trayning the ſmall ſhot, and little or none at all done in exerciſing the Gunners in the uſe of great Ordnance, being now in theſe dayes the very terror and feare of the wars, and in which ſervice one great ſhot well placed may do more ſervice then 100 ſmall ſhot can do; and therefore in my judgement it were a good courſe that alſo the great ſhot as well as the ſmall, might be exerciſed by ſome honeſt and skilfull Gunner, of which I doubt not but many in theſe dayes may be found, neither can I much blame the Gunners that do their ſervice in Caſtles or Forts, if they be unskilfull, becauſe they have no man to ſhew them any courſe or rule how to make a ſhot in a great Peece but how neceſſary a thing this would be, I leave to the wiſe and judicious ordering of the moſt honourable

This I held to be a neceſſary thing.

honourable houſe of Parliament, into whoſe hands by the Divine providence of God, is committed the whole ordering of the ſtate of this Kingdome, and whom I pray God to bleſſe in their proceedings.

As for my ſelf and the courſe that I have taken in this my work, is to no other end, but to help thoſe men that are ſtudious and deſire to approve themſelves good Gunners, and Loyall and faithfull to the King and State, and I do verily think that a Fort or Hold that is peſtered and cloyed with unskilfull and obſtinate Gunners, were as good be furniſhed with ſo many Traytors, for there is no good to be expected from them in time of need, when their ſervice ſhall be required; and therefore little good is to be expected from ſuch men. Neither do I expect any favourable cenſure or acceptation from ſuch men (and ſome others that are very captious and cenſorious of the workes of other men, when themſelves truly underſtand not the leaſt part of that they find fault withall) but to ſuch I ſay, as others formerly have done in the like caſe (in regard of the paines that I have taken, and the long practice I have made) commend it, or elſe come and mend it. And thus continuing my prayers to God for the happy Union of his Majeſty and Parliament, I humbly take my leave.

W. E.

THE

THE GVNNERS GLASSE.

CHAP. I.

A Dialogue or Conference betweene a practiſed Gunner, and a young beginner deſirous to be inſtructed in the Art of ſhooting in Great Ordnance.

Scholler.

SIr, I underſtand by many of my Friends, that you have taken great paines a long time in the practice of great Ordnance, which thing I am lately called unto and ſworne to performe, to the intent I may the better performe my ſervice to God, my King, and Countrey; I am now deſirous to take ſome paines and beſtow ſome coſt to bee inſtructed in the principall Grounds of this Art, holding it to bee a very abſurd thing to profeſſe this Art and to take upon me ſuch a Charge, and not be able in ſome ſort to performe the ſame; I therefore deſire

See here the deſire that ſhould be in a diligent Practitioner.

deſire you to give me ſuch inſtructions that I may perform my duty herein, and I will content you well for your paines.

Gunner.

Your deſires in this thing are good, and you are to be much commended for your care to fit your ſelf for the performance of your ſervice in your place; for he that can be content to take the Kings pay, and care not to do him ſervice, doth not onely diſcredit and ſhame himſelf, but alſo diſhonoureth God in ſeeking to get his living by a lazie kind of idleneſſe; which thing is forbidden by God: and therefore inſtead of a bleſſing, he bringeth a curſe upon all that he taketh in hand, and few things proſper under his charge.

Mark here the courſe of idle Gunners, of which I have knowne many that keep places in the Kings Forts, & doe know nothing.

Schol. I do much deſire to keep the favour of God, for I am well aſſured that without his favour and bleſſing whatſoever is taken in hand can never come to good effect; but I would have you to know, that though I deſire your help in this Art, yet I am not ſo idle, but I do my ſervice and duty in my place, and have ſo done ever ſince I was ſworn, which is now above two yeares ſince.

God muſt bleſſe all our actions.

Gun. I pray let me know of you what that ſervice is, which you ſo much reſt upon, what ſervice do you in this your place of a Gunner.

Schol. I do watch and ward when my turn commeth, and ſometimes charge a Piece, and I dare give fire to the ſame, and I think that this is as much as is ordinarily required by our Captain, and as much ſervice as moſt Gunners uſe to do.

Behold here the ſervice of the idle ſort of Gunners

Gun. Theſe ſervices are good and fit to be performed, but do you think this to be all that is required in a Gunner that ſhall receive his Majeſties pay, and is allowed for a Gunner, which although he doth watch and ward, and ſometimes charge and ſhoot off a Peece, I hope you know this is not all your ſervice, for which is given 6 or 8 pence a day, for you ſee by dayly experience, that men may be had ready for a leſſe ſumme; that ſhall do all this and more, whereas if men will look no farther but content themſelves with this courſe, they ſhall diſcredit themſelves and deceive the King in theſe his Caſtles and Forts, who doth expect Gunners, and alloweth a competent

The King & State is much abuſed in this thing in all his Forts and Caſtles.

meanes for the trayning and bringing them up in the knowledge of the Art of Artillery, to the intent they may ſerve his Majeſty in any other place when they ſhall be called, for where ſhall the King have men in time of need, but ſuch as have been trained and exerciſed in theſe Forts in time of Peace.

Schol. The reaſons that you here alledge are not to be much diſliked, yet by your leave I muſt tell you, that ſeeing there is no further ſervice required at the hands of moſt ſort of Gunners, then that which I have formerly ſpoken of, by thoſe that be Captains and Commanders what need men then to be ſo buſy with munitions, for which I know ſome more hated then encouraged being but a poor way to incourage a young beginner, and therefore in this caſe, I think it beſt to medle with no more then is required at my hand.

Conſider here the negligence of Commanders, for this is their fault.

Gun. This is not according to your firſt ſpeech, for you told me that you were deſirous of more knowledge, but if you mean to content your ſelf with this that you have aledged, you may do ſo, and ſo ſpare a labour both to me and your ſelf, for if you have knowledge enough already, what need you trouble your ſelf any further.

Schol. But Sir, I hear for certain that there is like to be a ſtrict Survey, as well of the men as of the holds, here within the Cinque-Ports, & other places that lie upon the frontiers of the Land, to know the worth and ſufficiency as well of the Captain as of the Gunner; which if it ſhould ſo come to paſſe, as it is never more like then now; I think I ſhall not only doubt my ſelf, but I fear it will go hard with others, which I think inferior to my ſelf in this thing; and therefore to avoid this feare, I doe intreat you to furniſh me if you can, with ſuch skill that I may upon ſuch an occaſion be able to give account of this my Profeſſion, and I will give you good ſatisfaction for your paines and ever acknowledge you for my Tutor, and be ready to do you any good office upon any occaſion.

Gun. Then I perceive it is fear of further danger and not Conſcience of your ſervice, that cauſeth you to ſeek help in this time of need, for indeed I do heare for certain that the Parliament will take a ſtrict view both of the Holds, and Men, and I

Such men as care more for their pay then to do the King Service, may more fitly bear the name of Traytors then of Gunners.

ſee no reaſon but thoſe Gunners that have incroached places, and have been muſtered and received pay of the King any long time, if theſe continue ſtill ignorant, they are worthy to be diſmiſſed of the places, and others placed in their rooms, for there are many will be glad to ſerve for a ſarre leſſe pay, ſo they may be privileged from other ſervices, and may prove able men and good Gunners; but whereas you are deſirous to be inſtructed, I am alſo willing to do my beſt, ſo that you will promiſe to be ruled by my Inſtructions, and alſo to ſhow your ſelf an obedient Scholler; for I have been very baſely and churliſhly uſed of ſome that have been beholding to me for my paines; and therefore I am loath to meddle with ſome kind of men in this buſineſſe.

This well conſidered wil eaſe a great charge in Garriſons and Forts.

Schol. I pray you let none of theſe doubts ariſe in your mind but proceed to that courſe of Inſtruction that you meane to proſecute for my playneſt directions in this Art, and I do here promiſe you both diligence and obedience in all that you ſhall requite of me?

This obedience ought to be in all yong Schollers.

Gun. You ſpeak well, and according to your ſpeech I think you wiſh to be beleeved to mean truly and plainly. Tell me then, what is your Calling or Profeſſion, or your trade or occupation, and if you can write and reade, and whether you have any knowledge in the Science of Arithmatick and Geometry, for all theſe things will be great helps to you in this Art, and from this time be bold to ask me any queſtion, for I do accept you for my Sholler and friend.

Arithmetick and Geometry fit for Gunners.

Schol. In my mind, you need not queſtion my Trade or occupation, ſeeing I now profeſſe to be a Gunner, and therefore I pray you let me know the reaſon wherefore you ask me this queſtion?

Gun. My reaſon is, that there are ſome Artificers more fit to make Gunners then others are.

Scholler, I pray you declare plainly unto me, what manner of men or Artificers you think moſt fitting to make good Gunners, and your reaſon why you would make choice of Artificers more then other profeſſions, for in my judgement theſe handy-Crafts men have not ſo much time as others that have more leiſure and ſpare time?

Gun-

Gun. It is true that many man have good time and leysure also to practise, but being brought up to a soft kind of life and used to take but little paine; they will not, nor cannot take that paines that other men will doe, that hath been trained up and exercised in labour & paines-taking; and therfore in my judgement all Carpenters, Smiths, Masons, Brick-layers, and strong, honest, and discreet labourers, and in a word all lusty men that are industrious, and diligent to learn what Occupation soever they be, may be fit to be trayned up in this Art, especially if they be indued with a competent knowledge to write and read, by which meanes they may attain to further knowledge in Arithmatick and Geometry.

Handy-craftsmen most fit to make Gunners.

Schol. By this it should seeme, you doe exclude those that are Schollers and Arts-men, which in my mind are the fittest of all other men to make Gunners; especially, if they will give their minds to study and practice this excellent Art?

Gun. I doe not exclude them though I doe not name them, but I doe hold such men most fit for this Profession, but such men are not alwayes to be found and are seldome seene to take upon them this Profession, because of other imployments, which if they be honest men they cannot lack, and I doe verily thinke these men of all other to be most fit in a Fort or Hold, if but one or two such men were placed among a discreet company, they might doe much good and bring on young beginners, if one thing were amended, which I see too cõmon in many places to my griefe and the discouragement of many a willing and industrious mind; and that is this, Let a man be never so Industrious and forward in his place, hee is by some Captaines no more esteemed then a very hog-rubber, and every Ignorant fellow in the company more or as much respected as the best Arts-man; this is a poore incouragement for a diligent Practitioner, and I wish all those that are Commanders to thinke of this thing, for it is a thing worthy the remembrance.

When Schollers and Arts-men will take paynes in this Art, they are most fit for Gunners.

The proud and scornfull carriage of Captains to the Gunner, is much to be disliked.

But as for Artificers before-mentioned they cannot be spared, because they be most fit to doe the worke and labour about the Ordnance; As for Example, what man more fit to remove a Peece and to bring her to her marke, then Labourers or such

Artificers cannot be spared about the Ordnance in Forts.

as are used to lift and handle great burdens, who more fit to perceive the faults and defects in the Iron worke of a Peece then a Smith, who more fit to give Directions for the mounting or dismounting of a Peece then a Carpenter, this being a thing that all Gunners ought to know and practice, and thus to conceive of all the rest. As therefore I doe not exclude good Schollers and Mathematicians, but wish with all my heart such men might be much respected; yet these men which I speake of can in no wise be wanting in a well governed Fort or Castle; and therefore I wish such men to be placed and well esteemed in Garisons and places of Warre.

Schol. I perceive by this, that you would have Gunners to be Labourers, and Labourers to be Gunners?

The order in the field and in Garisons, do much differ

Gun. In places of quiet Garisons such as we now live in, it ought to be so where there is allowed but few men, but in the Warres and time of great necessity, it is most fit that every man keepe his appointed place and attend to that the Mr. Gunner shall appoint him.

Schol. Doe you think then, that a Mr. Gunner should command the inferiour Gunners in a Place or Fort where there is a Captaine; to what end then serveth a Captaine, and what doth hee command in a Fort where there are none but Gunners?

A Captain may command a Gunner to do his service, but not how to do his service, because he hath no skill in the Art.

Gun. The Captaine of a Fort surely doth well in a Fort, to see all things well ordered, and I doe hold it fit there should be a chiefe Commander, but I see few Captaines that are Gunners; for a Gunners art is a thing chiefly studied and practised by Gunners only, and I doe not thinke that a Captaine will stoope to such a Place except upon great necessity; but let him leave the businesse for the Ordnance to the Mr. Gunner, whose place is to see all things belonging to the Ordnance fit and serviceable, and so every man to meddle in his owne place wherein hee is appointed, which Mr. Gunner ought to be wise and discreet and an Arts-man, and willing to give Instructions to the other his fellow-Gunners.

All things belonging to the Ordnance to be left to the Mr. Gunner.

Schol. Sir, I pray you declare briefly to me the Office and duty of a Mr. Gunner; because I have heard and also seene in many

many places no Mr. Gunner, and little reckoning made by ſome Captaines of any ſuch Office or place, ſuppoſing it to bee a diſparagement to the Captaine?

I know ſome captious Captains have thought ſo.

Gun. It is certaine that this Office is the moſt chiefe and eminent place in a Fort next to the Captaine, and hee is to ſee that all things belonging to the Ordnance be fit and in a readineſſe; and firſt hee ought to be a man of good diſcretion, and one that makes conſcience to ſerve God, and alſo to be indued with a competent knowledge in the Mathematickes, and to know the uſe of all Inſtruments for platting of Fortifications and taking of Diſtances, to have skill to ſet out the platformes and placing the Ordnance upon every place for the beſt and readieſt ſervice, to ſee the Ordnance be well fitted in their Cariages, to ſee that his Peeces be not defective, that they be even and truly boared, what flawes, cracks, or Honey-combes be in any of them, how they be fortified that they may beare their due Charge without danger, that the Cariages for the Ordnance be well and proportionably made to Caliber his ſhot, and to fit and make all manner of Ladles, Cartridges, Spunges, and rammers for all his Peeces, to make his Quadrant, ſight, rule, and other Inſtruments, for levelling and making his ſhot, and taking of Diſtances, and to teach the other Gunners the uſe of all ſuch Inſtruments as are fitting for the ſame; with many other things belonging to the place and Office of a Mr. Gunner, whoſe chiefe Care ought to bee as well for all neceſſaries for the ſervice of the Ordnance, as alſo for all ſuch Gunners as ſerve the King, that they may doe their good and true ſervice.

See more of this in the laſt chapter of this book of the examination of a Mr. Gunner.

Schol. I perceive by this your ſpeech, that a Mr. Gunner is of great uſe in a well governed Fort; and therefore to be cheriſhed and incouraged by thoſe that are Captaines and Commanders of all ſuch Forts, that endeavour to be well reputed in their Places and love the Service, for I perceive the chiefe ſervice in a Fort or Caſtle in theſe times, doe conſiſt in good Gunners?

A Maſter Gunner of great uſe in a Fort.

Gun. You ſay the truth, and therefore I do wiſh every Captain if he be not allowed a Mr. Gunner, yet that he would make choice of the moſt ſufficient man in his company and make

A good advice for Captaines.

make him his Mr. Gunner, and commit the charge of the Ordnance and thoſe things belonging to the ſame, unto him, and to reſpect and countenance him above other, which will be a great eaſe for the Captain, and a great incouragement to ſuch a man to practice his Art; but I utterly diſlike the changing every moneth of the Mr. Gunner, by which meanes in very truth there is as good as no Mr. Gunner; and I could alſo wiſh, that deſerving men might be better and more highly reſpected then thoſe that look to live idlely in their place, for this is the cauſe of much quarelling and contention, when the good and the bad are conſidered alike.

This is but a fooliſh courſe to make a Mr. Gunner every month.

Schol. It is true, that pride and ſelf-conceit is the cauſe of much contention; for I have heard very great brags out of the mouths of very ignorant fools, and only becauſe in a fancy and over-weaning manner think none, ſo wiſe, or ſo good as themſelves; and therefore, that I might avoid this imputation, I do heartily deſire to be inſtructed, and I pray let me know what manner of man, and qualities, ought to be in a Gunner; and what is the firſt thing that a Gunner ought to obſerve, that I may be inſtructed, how not onely I my ſelfe may be ready to diſcharge ſuch a place, but that if I be called hereafter to the like, I may be able to direct others, if occaſion ſerve; to be diligent and induſtrious in performing this their duty and ſervice, both for the honour of God, their Oath of Allegiance to the King, and the conſcionable diſcharge of this my place of a Gunner?

This is too common now adayes among ignorant fools, that can do no thing, and yet will brag very much of their fooliſh skill.

DIALOGVE. 2.

Shewing what manner of man he ought to be that will take upon him the office of a Gunner, and what is first to be observed in this Art.

CHAP. II.

Scholler.

NOw Sir, I pray you let me know your opinion touching the man that will undertake the profession of a Gunner, what manner of man he ought to be in qualities and conditions, and also what is the first thing to be observed by him that will be a Gunner?

Gun. Touching the quality and condition of the man that will be a Gunner; in my judgement, he ought to be first, and principally, a man fearing God, & by all meanes possible, to walk faithfully before his sacred Majesty, with an upright heart, not given to much talking or many words, no quarreller or drunkard, or Idle gamester, or companion, but sober, honest, and of good conversation; and chiefly, hating pride and boasting of his own worth, indewed with knowledge and skill in the profession of the Mathematicks; as Arithmetick and Geometry, all these may do well, if it may be, if not some of these, as to write and reade, and such like things, and qualities ought to be in a well qualified man that will take upon him the profession of a Gunner, and so by the blessing of God, and good and diligent industry, this man may prove excellent in this Art.

Behold he the condition of a good man that may be to make a good Gunner.

Schol. It is a rare thing to find all these things in a man, but I think if a man be carefull and watchfull over his own wayes, he may go farre in these things, if God set too his assisting, and blessed hand, which God grant?

But as for me, I let you know, I can write and reade, and I have a little skill in Arithmetick, and I hope I shall be capable of such instructions as you shall deliver unto me, but I pray you in as brief and plain a way as you can let me know the first thing to be considered.

Good helps in a Gunner to wright and read, and to be skilfull in Geometry.

☞ Mark here the chief practical knowledge of a Gunner.

Gun. The practicall knowledge of a Gunner doth consist in three things; namely, the first is to know his Peece, the second thing is to know her Execution, and the third thing is to know the Distance to the mark; in these three things (and therefore marke them well) with a few other things depending doth consist the whole Art of Gunnery, or the perfect way of shooting in great Ordnance, and these things I mean to handle at large, leaving out no one thing that may be said concerning the particulers of each of these by themselves; and first concerning the knowledge of the Peece, of which for your better understanding, I would have you to move the questions.

Touching the mettal of a Peece.

Schol. If you will have it so, then I pray tell me what mettal you hold most fit for great Ordnance, whether Brasse or Iron?

Gun. The common received opinion both of many worthy Generals, experienced Souldiers, and Gentlemen that have used the Warres, is, that Brasse Ordnance is the best, because of the smoothnesse and cleannesse of the mettall, and commonly they are not so heavy, but then they are not so strong to indure the proportionall weight of Corn-powder, which is used in these dayes; and therefore they cannot bear so much powder, and by that reason cannot do so great execution; for a due proportion of powder causeth a Peece to carry further, and goeth more forcibly, then when the powder is diminished, for there is a due proportion to be observed in all Peeces and most fit to be known; now again your Brasse Ordnance being hot with often shooting, as at Batteries and the like, when they be hot become very weak, and will not indure there due proportion, but will be in danger of breaking; and therefore in my opinion the Iron Ordnance is better and more serviceable then Brasse, for they are stronger, and will do greater execution, that is, they will carrie further.

Mark here a due proportion of powder.

Iron better then brasse Ordnance.

Schol. But I have heard it reported, that Brasse Ordnance will not flie in peeces when they break, but only split, and therefore some do like them better then Iron?

Gun. I have heard many men say so also, but I have seen it otherwise, for being at *Rye* in the yeere 1613 among other Ordnance, a Brasse Saker being fired, did break and some pieces of great

great weight did fly a great way, whereof one piece of above a hundred weight ſtruck the Mr. Gunner in two parts ſtark dead, this was a Braſſe Saker of 1600 weight; Alſo in *Anno* 1625. at the time when our gracious King CHARLES came to *Dover* Caſtle, a Braſſe Saker of 1700, brake in 20 pieces, of which ſome pieces flew a great way, but hurt no man, and divers other Braſſe peeces hath bin known to fly in many pieces when they break.

A ſtrange accident at Sea, 1613.

Schol. What is the difference of the weight of the mettal between Braſſe and Iron Ordnance?

Gun. Theſe Braſſe Sakers which I ſpake of before weighed as I told you, between ſixteen and ſeventeen hundred, and your Iron Ordnance of the ſame height of bore, do now in theſe times of founding, weigh 2500, a little more or leſſe.

Schol. By this I ſee that your Iron Ordnance is farre ſtronger then Braſſe, becauſe they have a greater quantity of mettal but whether Braſſe, of it ſelf be ſtronger then Iron, that is a queſtion, but that may be beſt decided by thoſe that have skill in the nature of mettals, I think it doth not much belong to the Art of a Gunner?

Iron ſtronger then Braſſe.

Gun. We will not ſtand much to diſpute this matter, but this I know and have found by good experience, that Braſſe, the hotter it is, the weaker it is; and Iron Ordnance the heat doth not hurt it any thing at all; alſo your Braſſe Ordnance is compounded of divers other mettals, as Copper, Latten and Tinne; and Iron but of one onely mettal, and therefore is the ſtronger, for unity is more forcible then plurality.

Braſſe moſt weak when it is hot.

Schol. You ſaid that the firſt thing belonging to a Gunner is to know his Peece, and in my judgement it is an eaſie matter to know a Braſſe peece from an Iron peece?

Gun. This is very eaſie except it be to a foole; but this is not my meaning, but I ſay that a Gunner is firſt to know, of what kind or ſort his Peece is, and not of what mettal; although this is alſo to be known becauſe of the proportion of the mettal wherein the one doth differ from the other, but my meaning is of what kind every Peece is, whether it be Falcon, Minnion, Saker, Demy Culvering or whole Culvering &c. As alſo the weight,

Marke here what it is to know his Peece, one of the firſt 3 Principles.

weight, height, length, fortification, diſpart and many other things belonging to a peece of Ordnance, without the which, no Gunner can uſe a Peece, nor give her the due charge, nor when ſhe is charged can make a perfect ſhot.

Schol. Sir in my judgement, you have named more things then is needfull to be obſerved in a Peece; for if a man come to a peece, and know the place or mouth where to put in Powder, and the toutch-hole where to give fire, it is enough, and therefore what needs any more.

The foolish reaſon of idle Gunners.

Gun. You ſaid you would be rul'd by my inſtructions, and therefore mark me well, and give me a direct anſwer to that I ſhall demand; and firſt, becauſe you ſay you are a ſworn Gunner, then tell me in what Caſtle or Fort, belonging to his Majeſtie, you now do your ſervice.

Schol. I ſerve in *Deale* Caſtle, or *Dover* Caſtle, upon the Eaſt Mount, or ſometimes upon the ſquare Plat-forme.

Gun. With what Ordnance do you ſerve upon the Eaſt-Mount, and what are the names of the Peeces there under your charge.

Schol. There be both Braſſe and Iron, and ſome are called Sakers, demy-Culvering, whole Culvering?

Gun. How know you that theſe Peeces that you have named, be Saker or whole Culvering or whole Culvering.

Schol. The Gunners that were there before I came told me ſo, and I think they can tell, for otherwiſe I do not know.

Gun. Are you a ſworn Gunner, and do you take no more care to know your Peeces, but by the report of others; I tell you you are greatly to be blamed for your idleneſſe, and for neglecting ſo chief a buſineſſe, and it is a marvel that you are not put out, having had a place now two yeares, and yet know not your Peeces, and to name them, will neither your Mr. Gunner, nor your Captain, ſee you be taught that plain leſſon?

I have known this fault in Gunners of 12 yeere ſtanding that could give no reaſon of this thing.

Schol. We have no Mr. Gunner, and as for our Captain, I think he knowes not theſe things, or if he do will think much to inſtruct ſo mean a man as my ſelf, and as for a Mr. Gunner, I do not ſee any Captain to make any reckoning of any ſuch place, holding it to be a great diſparagement for a fine brave Captain

Captain to have a Mr. Gunner, and therefore he remaines ignorant himself, and many such young Gunners as I am, do feare the worst, and remaine still blind Gunners.

A great negligence in a Captain.

Gun. If your Captain did but know what an ease and also what a commodity, what credit and reputation, a good and diligent skilfull Master Gunner were in a Fort, to look to the keeping of the Ordnance, to the turing the wheeles, to see the platform neat and clean kept, without weeds, and to see all things belonging to the Ordnance kept neat and decent, to keep a comely Gunne-House with all manner of instruments, as Callipors and other Compasses, Sight-rules, Quadrants, and all other things belonging to a Gunner, and many other things too long here to name or recite, to the end that when any Arts-man or traveller shall come and demand any question, he may be ready to make him an answer to any question that he shall propound, these things I have seen in my travels both in *France*, and *Germany*; and therefore if your Captain be a Souldier, or but love Souldiers, he would make as much of a skilfull Master Gunner as his right hand, but I heare that your Captain bought his place, and therefore may be ignorant of this most necessary course of discipline?

Schol. Sir I pray you leave this discourse, and show me how I shall know one Peece from another, and also all kind of Peeces, that are now most in use amongst us in our warres, for as I gather by your former words, that it is a thing of great use.

Gun. It is true that I told you, and so materiall a thing that he that professeth the Gunners Art without this knowledge, is no more fit to be called a Gunner, then an Asse to be called a Horse of Warre, and therefore mark the direction that I shall give you touching this thing. All Peeces of what kind soever, are known by the height of the bore, and this height of the bore is called of most Gunners the Calliber, yet there are some that account the Caliber by the height of the shot or ball belonging to such a Peece, but how soever the proportion of all Peeces is derived either from the height of the bore called the Calliber, or the height and weight of the shot called the Ball, as when

A direction to know all manner of Peeces.

Both the Peece and carriage is made according to the Caliber of the Peece.

we say a Peece is so many Callibers in her chase, or so many bales, and note that all Peeces of Ordnance whatsoever, are made by this proportion, and not onely the Peeces themselves, but also the Carriage, the Wheeles, the Naves, the Extre, and all things that belong to the carriage; also the length and bredth of the Ladles, Cartriges, Rammers, Spunges, and many other things belonging to Ordnance, are all derived from the Caliber, as you may see at large in the book named the Practice of Artillery written by *Ufano* Captain of the Castle of *Antwerp*.

The names of most of the Peeces in *England*.

Schol. I pray you tell me the names of such Peeces of service as are most in use here in *England* with their height of the Bore, or Calliber, the ordinary length and weight as neere as you can, because I may know them hereafter when I shall be demanded?

Gun. I will doe what I can, but though all Peeces are to be known by the height of the bore or Caliber, yet both the length of the Peece, and the weight of the mettal may differ much, as I have known some Sakers of 8 foot in length, and of 2000 weight, and other Sakers of 9 foot ½, and of 2600 weight, and so of all other Peeces. But to give you content, I will do my best to satisfie you, behold this Table wherein you see the Names and height, or the Caliber of most Peeces with us in use.

A Table

A Table of the height and weight of Peeces.

The names of the Peeces.	The Caliber or height of the Boare.	The weight of the Shot.	The length of the Peece	The weight of the Peece
A Rabonet,	1 ½	¼ l.	3 foot	120 l.
A Falconet,	2	1 l. ½	4 foot	210 l.
A Falcon,	2 ½	2 l. ½	6 foot	700 l.
A Minion	3	4 l.	8 foot	1500 l.
A Saker,	3 ½	5 l. ½	9 foot ½	2500 l.
A Demy-Culvering	4 ½	9 l.	10 foot	3600 l.
A whole Culvering	5	15 l.	11 foot	4000 l.
A Demy-Cannon,	6	27 l.	12 foot	6000 l.
A whole Cannon,	7	47 l.	10 foot	7000 l.
A Cannon Royall,	8	63 l.	8 foot	8000 l.

Here you may see the names of those Peeces that are in chiefest use here with us in *England*, but there are divers other Peeces

ces of great Ordnance, which I forbear to place in this Table, because they be of several Calibers or heights, but not much differing, as some are called Dragons or Drakes, and some Basiliskes, and are so named because of their extraordinary length, although their Calibers do not much differ as in *Dover* Castle there is a Basilisco, whose Caliber or height of the bore is 4 inches $\frac{1}{2}$ and better, but 63 Calibers in length in her chase, that is 23 $\frac{1}{2}$ foot; also there is a Peece in *Deale* Castle, which they call a *Norenburg* Culvering of Brasse, but she is but 4 inches $\frac{1}{2}$, and in length 16 foot, but all Peeces of our modern founding may be and are reduced to these ten kinds specified in this Table, wherein you may see, first the Names, then the height of the bore or Caliber, the weight of the shot, the length of the Peece, and the weight of the Peece, which is as much as is requisit at this time?

Note here the names of Peeces extraordinarie.

Schol. Now I am pretty well instructed in the course of naming the Peeces, I pray you proceed to the next thing to be considered in a Peece of Ordnance.

Gun. If you remember, I told you that all Peeces do beare the proportion of their Caliber, in all the parts thereof, both for the length of the Chase, for the thicknesse of the mettal in the Chamber, and at the Tronions, and at the neck; by which proportions, the Gunner doth know what weight of Powder to allow to every Peece according to the strength or feebleneese of his Peeces; and for this cause, it is that so much paine and labour is taken, to know the measure of all manner of Peeces, to the end that he may know how he may allow a just quantity of powder, according to the strength of his Peeces?

Schol. Sir, I remember you told me, that the whole proportion of a Peece was derived from her Caliber, which name I do partly understand and is as you have explained it, the height of the bore of any Peece, but for the names which you now spake of, as Chase, Chamber, Tronions, Neck, and the like; I know not what you meane thereby, I pray you therefore declare to me in order the names of all the principall parts of a Peece?

A necessary demand.

Gun. This motion was well made, for indeed it is fit to explain the parts of the Peeces, before any rule can be given in any

any of them, but these things being so ordinarily known of Gunners, I thought you had known them as well as others.

Schol. I do not remember that I have ever heard them named, or if I did, I knew not what they meant, and therefore I account those men happy that have a skilfull man alwayes at hand to teach them, and then those that then are ignorant let them be well blamed.

Gun. You say well, but to our purpose of the names of the parts of a Peece; the height of the bore is called the Caliber, the hollow of the said bore from the mouth to the britch is called the Cylinder, and of some authors the Soule, but others the Chase, the nethermost part thereof next the Touch-hole extending from the Touch-hole towards the mouth about some 2 foot or 18 inches, is called the Chamber, for in it lieth the powder, Shot, and wads, and according to the thicknesse of the mettal in the said Chamber, is the allowance of powder to be given as you shall see hereafter the uppermost part of the mettal at the breech of the Peece is called the Base-Ring, the part of the Peece from that to the Button, is called the Carnous, the Rings of the mettal, that compasse the Peece round about which are left higher then the mettal are called Frises, of which the midlemost is called the Girdle, the uppermost part of the mettal or Frise at the mouth, is called of some the mussell-ring and of some other Authors the Ioy. The two knobs proceeding from the sides of the Peece, serving to hold the Peece in her carriages, are called the Tronions, and the mettall of the Peece next the mouth, is called the Neck of the Peece there are other parts both of the Peece and Carriage might be named but these at this time may suffice for a beginner.

Let all Gunners learn to be perfect in this knowledge of the parts of his Peeces.

Schol. I thank you sir for this instruction in the names of the parts of a Peece, in which I perceive they are both necessary to be known and learned, but also very usefull in most occasions to be known and practiced of every Gunner, for without this, the Gunner may mistake many things, and fall into error, now I pray you proceed to the next thing.

Gun. I think I have spoken sufficiently concerning the knowledge of a Peece in generall, and therefore the next thing now were fit to speak of the Carriage, and the mounting there-

of; but before I proceed to speak of that, I will speak a little of Chambered Peeces, which are such Peeces as have their mettal left thicker about the place of the Chamber within, by an inch or an inch and a half; then the rest of the Chase or Gilender of which there be two kinds, and are severally named; the one is called a Bell-bored-chamber, because the Chamber is small at the lower end next the touch-hole, and so groweth wider and wider toward the mouth, in the fashion of a Bell; and continueth in length from the breech of the Peece toward the mouth, the length of 5 Balls or Calibers; the other is called a square Chambered Peece, because the Chamber continueth in thicknesse all alike in mettal, *viz.* As big below as above, and is also the length of 5 Calibers. These Peeces are very ancient, and were invented for strength to beare the better charge of powder, though the mettal of the rest of the Peece be but somewhat weak, and most commonly these are Brasse Peeces. The Peeces also which are called Cannon Periers, are for the most part Chamberd Peeces, and are used to shoot Stone shot; there are also Peeces called Basses, which also be used with divers Chambers; I have seen of these both of Brasse and Iron, having two Chambers to a Peece, that when one is discharged, then presently to clap in another; these I take to be very serviceable but now they are not used. There are also Peeces of another kind called Morter-peeces, because they be short, and are almost like a Mercers-morter; these are of excellent use, and require great Art to use them; but at this time I will passe it over till a more convenient time, for it will require great skill to shew the use therof. Now I pray you gather up these things and consider what you ought to do touching the knowledge of your Peeces which are under your charge, that you may perform your duty with a good conscience to God, and your loyall service to the King, & your duty to the Captain, or Commander whom you serve, and that you may gain the greater reputation, consider what hath been shewed you touching ye knowledge of your peeces, and mark and consider well the sound of the same; whether they be sound and without cracks, and whether smooth and even bored, and cleere from creveses or hony-combes within, then con-

Bell Chambred Peeces.

Square Chambred Peeces.

Cannon Periers.

Basses.

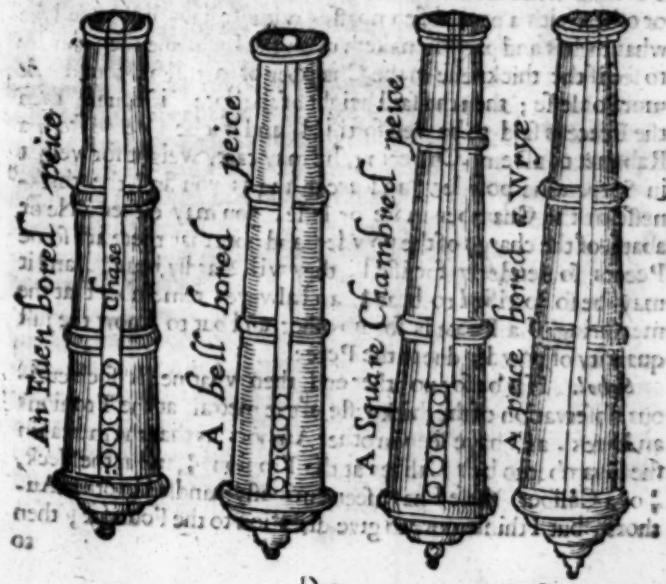
Morter-peeces.

Morter-peeces of great use in the Warres.

Mark well this direction.

conſider the Caliber or height of the Bore, remembring that the whole proportion of a peece, doth depend, and is derived from the ſame; and thus, how many Calibers in length, what part of a Caliber in the Chamber, in thickneſſe of mettal, that is to ſay, how fortified in mettal, alſo what at the Tronions, and at the neck, and that the Tronions be well placed, that the Peece bee not too heavy or too light in the breech; for if the peece be too heavy, the more help muſt be uſed to Coyn her up to her marke, but if too light in the breech, then ſhe will bob down her muſſle and lay her ſhot ſhort, which I have often ſeen, to the great diſcredit of the Gunner: alſo to obſerve whether your Peece be upward or downward bored, or awry either to the right or the left hand, and that ſhe be even bored within, *viz.* Not one place wide and another narrow, and many other things which you may practice by your ſelf, now I will endeavour to ſhew you the figure of all theſe peeces as followeth.

A ſpeciall note for all Gunners to obſerve.



A ſumme of Chambered Peeces.

DIALOGVE. III.

Of the measure and proportion of a Peece of Ordnance, and of her Carriage and Ladles. And of the mounting thereof.

CHAP. III.

Scholler.

SIR, I thank you for this paines, I do well understand this; I pray you now show me the way to measure a Peece, and to know if she be truly and proportionally cast or founded?

Gun. First take the height or Caliber of your Peece, of what kind soever it be, as Saker, or Demi-Culvering, or other, with a payre of compasses with streight points, and see what inches and parts it maketh upon the Inch-rule: then you are to see if the thicknesse in the Chamber of mettal be equall, or more or lesse; then the said height of the bore, if equall, then the Peece is said to be well fortified, and if it be a Peece from a Rabonet to a Demi-Culvering, she may carry weight for weight in Serpentine powder, and according as you find the thicknesse in the Chamber more or lesse, you may either adde or abate, of the charge of the powder, and note that there are some Peeces so slenderly fortified, they will hardly bear $\frac{1}{3}$, and it may be so fortified to bear $\frac{1}{2}$, and alwayes remember that the measuring of a Peece is for no other end but to know the just quantity of powder due to the Peece.

The way to measure a Peece.

Note this of the quantity of the Powder.

Schol. If it be for no other end, then what need is such curious observation of the thicknesse of the mettal, at the Tronions and neck, as I have seen in other Authors as that the mettal in the Chamber to be 1 Caliber at the Tronions $\frac{1}{7}$, and at the Neck, $\frac{1}{9}$ of a Caliber, these I have seen curiously handled in other Authors, but I think more to give direction to the Founder, then

to

to the Gunner, for the Gunner muſt take his peece as he finds it, nevertheleſſe, I will have recourſe to thoſe Authors as I ſee occaſion.

Gun. You ſay well, and for that cauſe, I will omit to ſpeak more of this thing, for if you can get the book ſet out by *Vfano* the Captain of *Antwerp* Caſtle, you may find many excellent rules therein, touching this Art, but now let me ſee how you have profited by theſe inſtructions, by this that I ſhall aſk you; here is an Iron peece, tell me what is the name thereof, what length, what height, and what thickneſſe of mettal, the nature of her Chaſe, the weight of her ſhot, and the quantity of the powder, due for her juſt charge? A neceſſary queſtion to a Scholler.

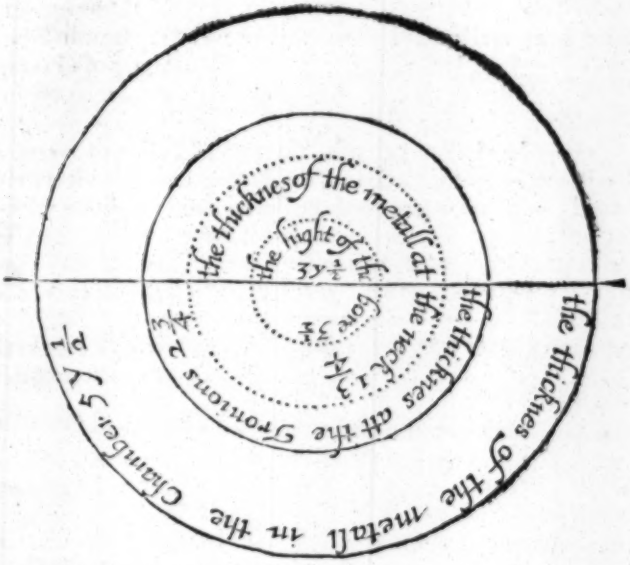
Schol. Some of theſe ſeem hard to me, nevertheleſſe, I will try what I can doe, deſiring your help if I faile, I muſt firſt take the height of the bore or Caliber, which I do with a payre of ſtraight pointed Compaſſes, and placing that upon the Inch rule, I find the wideneſſe to be 4 inches $\frac{1}{2}$ and better, and therefore I ſee that it is a Demi-Culvering; But if it had been 5 inches $\frac{1}{2}$ then a whole Culvering, and if 3 inches $\frac{1}{2}$ a Saker, and ſo of the reſt; now for the length of this Demi-Culvering, according to her Caliber (for ſo I take your meaning) and now I place my Compaſſes that ſtandeth at the wideneſſe of the Caliber of the bore, and begin at the top of the mettall at the mouth, and ſo I account from thence to the Baſe Ring at the breech, and I find that meaſure 27 times, and ſo I ſay the Peece is 27 Calibers long, which is about 8 foot, now this Peece is 3 inches - thickneſſe in the mettal, at the Chamber is 4 inches $\frac{1}{2}$, ſhe is even bored and ſmooth in her Chaſe, and hath neither cracks, flawes, nor hony-combes, and by the rule that I have learned of you, ſhe may well carry 10. l. of powder, but this muſt be Serpentine powder, for our powder that is now made is twiſe as ſtrong, for a Demi-Culvering ſhot of 4 inches $\frac{1}{2}$ weyeth 10. l. as I have heard, but as yet I know not that rule; nor the way to take the thickneſſe of the mettal of the peece in the Chamber or at the Tronions, or at the Neck; by which I muſt be guided for the quantity of the charge; I pray you therefore ſhew how I ſhall do it? Mark well this practice to meaſure a Peece. Our Corn powder in theſe times is farre ſtronger then it was in old time.

Gun. For taking the thickneſſe of the mettal in the Chamber of any Peece, you muſt have a priming Iron, or a great wyre crooked at the end, which you muſt put down in at the Touch-hole, and when it is down beyond the thickneſſe of the mettal of the Chamber, then draw it back till the crook take hold or reſt on the inſide of the mettal, then make a mark upon the wyer, even with the mettal, of the mettal of the Peece, or Chamber above upon the Chambers, then draw it out, and go to the mouth, and ſee if that thickneſſe be equall, or more or leſſe then the Caliber or bore of the Peece, if it be equall your Peece is well fortified, if more, the better fortified, if leſſe, you muſt abate of your charge according to diſcretion.

Obſerve this well for the mettal in the Chamber.

But there is a more ſure way to meaſure a Peece for this purpoſe, as thus, take the height of the Caliber at the mouth with a payre of ſtraight pointed Compaſſes, and draw upon a bord a ſtreight line, and pitch the Compaſſes in the line, the ſame wideneſſe remaining, then devide that wideneſſe in two equall parts, making a prick in the midle for a center of your whole work, then pitch one foot of your Compaſſes in the ſaid center, and extend the other, to one of the marks before noted, and ſo draw a Circle which ſhall ſhew the height of the bore; then with a payre of crooked Compaſſes called Collipors, take the thickneſſe of the mettal at the Neck, and the half of that with your ſtraight Compaſſes, and pitch one foot in the Center, & make another Circle about the firſt, do the like alſo at the Tronions, and Chamber over the Touch-hole, and ſo you have the thickneſſe of the mettal in theſe three places, *viz.* The Neck, the Tronions, and the Chamber which is as much as needs; and thus your work will ſtand.

A perfect way to measure a Peece.



Here you must consider this Figure is projected by a Scale of a quarter of an inch to an inch, *viz.* Every quarter of an inch is an inch upon the Peece; as take the Diameter of the bore in this example with your Compasses, and set that wideneſſe upon your rule, and you shall find it to be three quarters and an eighth part, that is upon the Peece three inches and a half, for every quarter upon your scale or rule is an inch, upon the measure of the Peece. *viz.* The height of the bore of three inches and a half thickneſſe, at the Neck one inch and three quarters, at the Tronions two and three quarters, and in the Chamber five inches

Note here the working by the Scale.

ches and a half, by which rule you may see she is doubled, and may well bear the weight of her shot in powder being six pound.

I would have you mark dilligently the order of this working by Scale, for it is a thing of great use in all Mathematicall conclusions, and it may be I may make use of the same in some other things, and thus much touching the measure of a Peece, which is to no other end, but to give her the due charge in Powder.

Schol. I understand by this, that the chief thing to be considered is to know the Caliber of the Peece, how often it is contained, both in the length of the Peece, and also in the thicknesse of the mettal, what parts of the Caliber are contained, as well in the Chamber, as also at the Tronions and Neck, this being a fit thing to be known; concerning the strength or weaknesse of a Peece, but I have read in the Practice of Artillery of a more industrious way (as he calleth it) to measure a Peece, but I do not as yet well understand the same, I pray you declare the same unto me.

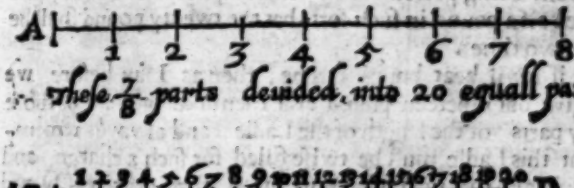
Gun. This is specified in the latter part of the second *Chap.* of the third book of the said Practice of Artillery; where he teacheth not onely the measure of a Peece to give her her due charge, but also the making of all manner of Ladles in due proportion for any Peece; which I will explain more hereafter. But concerning this your request, take his own example of a Culvering of 5 inches Caliber, you must divide that 5 inches into 8 equall parts, and then take 7 of those parts which there he calleth the $\frac{7}{8}$ parts, and then divide that $\frac{7}{8}$ into 20 equall parts, and then see how many of those parts are contained in the thicknesse of the mettal in the Chamber, which if the mettal in the Chamber and the Caliber of the bore be equall, the Peece is well fortified, but if more or lesse, you must adde or diminish of the powder, allowing a pound of powder for every division, and for every half part, half a pound, and for every quarter part, a quarter of a pound this is *Vfano's* meaning, the Author of the book called the Practice of Artillery.

This is a pretty rule if you can understand the same

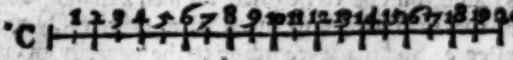
Gun.

Schol. I pray you let me try this demonstration my self, and thus I begin; First, I take the Caliber of the Culvering being five inches and place it upon a straight line thus.

The Caliber of five Inches into 8 parts.



these 7/8 parts devided into 20 equall parts



And I divide this line into eight equall parts, and set number to them as you see, then I take 7 of those 8 parts with my Compasses, and place it upon the second line, and I devide that second line into twenty equall parts, and number the same as you see, now I must find the thickneſſe of the mettal in the Chamber, which I may do according to your former rule or with a crooke pointed Compaſſes, and I find by this rule the thickneſſe of the mettal to be three inches and 3 quarters which I take between my Compaſſes, and that wideneſſe remaining, I try it upon this second line, and it reacheth to sixteen and ¾ whereby I conclude, I may give the Peece sixteen pound and three quarters of powder for her charge.

Gun. That is well done and here you see that we need not regard the measure of the Peece at the Tronions and Neck, nor the differences of the Peeces Reinforce, or Amoindres, all requiring the same order of measuring, which tendeth to no other end then to know the force or weakneſſe of the Peece, to give her powder requiſite, that it may be uſed without danger. Now you muſt understand that if your Peece be faulty or crazie you may at your discretion abate for a nineteen part, eighteen, seventeen or sixteen, nineteen pound, eighteen pound, seventeen pound; according to the parts which you may adde or diminish as you please, even to an ounce, and this is an ordinary rule for all manner of Peeces; of whatsoever Caliber they be;

be; now your Peece being thus measured, you may by this rule make a Ladle for the same, the seven eighth parts as afore said, must be devided into twenty equall parts, and the Ladle must be no longer then 3 balls, requisite for the charge, these three balls being parted into twenty equall parts, every one shall be half a pound in such sort that the twenty pound shall be used at two times.

I have no great desire to follow this rule

But if it will bear but nineteene, then as I say before, we must give but nineteen pound, and then take out one of those twenty parts, of the length of the Ladle, and alwayes remember that this Ladle must be twise filled for such a charge, and regarding also that the Ladle be so fitted, that it turn easily and freely in the Peece, and made according to the capacity of the bore of the Peece for which it must serve, being according to the thicknesse of the mettal in the Chamber, and let your Ladle be made fit to goe home to the very breech of the Peece, and let it be nayled or riveted with Brazen or Copper nayles, and this rule may serve for all manner of Peeces, great or small, but in the smaller Peeces, the Ladles may be made for once filling, and for greater at twise, and for the greatest at thrice, alwayes keeping the proportion of the twenties.

Schol. Are there no other rules for making of Ladles, for though they are made to our hand here in his Majesties Forts, yet in the field may be great need of the Gunners direction for making of them for all manner of Peeces.

Gun. The making of Ladles and Cartriges, are of speciall use either at home or abroad; But to give more rules then is needfull would be but in vain, and for to repeat again other mens works, you see, that as all other things, so the making and cutting out of the Ladles, dependeth upon the heighth of the Ball or Caliber, and therefore mark the Cannon reinforce must have her Ladle 2 Balls and a half in length, and in bredth three Balls, wher of one is to be cut out, and this Ladle to be twise filled to charge the Peece; besides the lapps that shall Compasse the Button or Firmer head when it is nayled, which head must be one Diameter or Ball in length to passe the staffe into, and as I said, the plate or Bralle to be two Calibers in

Mark the common Ladle, Reinforce.

breth

bredth, *viz.* half a Caliber on each side, beside the part that must be rivited, that it may be a fit length to Compasse the Button or Firmer.

The Button or Firmer, whereupon the Ladle Plate is nayled or fastened, ought to be in length one Caliber and ½ part, and in such thicknesse, that when the Plate is Compassed therewith, it may be even with the vent of the Ball. Firmer.

For Spunges, the Button or Firmer ought to be of soft Wood, in length a Caliber and two third parts, and no more then two third parts of a Caliber in thicknesse, because it must be covered with a woolled Sheep-skin, and nayled or fastened with Brazen nayles. Spunges.

The Button or Rammer-head, ought to be made of strong or hard Wood, in length one third part of a Caliber, and turned and fitted of such bignesse that it may enter into the Peece without any vent, or allowing no vent of the Ball, making certain Circles or creases backward upon the Rammer, in the which you may bind the same with strong twine, or brasse wyer to keepe it from splitting or cleaving, when you ramme up the powder or wads, and all these Buttons must be abated behind the two third parts of a Caliber, the better to goe into the Peece. Rammer-head.

The Staffe ought to be of good Ash-wood, Straight, of the thicknesse of an inch and a halfe at the least, and of such length, that it may be longer then the Peece at the least a foot. Ladle and Spunge-staffe.

For the Common Cannon, the Ladle shall be of the same bredth, but the length thereof to be but 2 ½ Caliber, and for the Amoindre or lessened to be but two Calibers to charge the Peece twise.

As for Saker Ladles, and Falcon, you may make your Ladles to load at once according to this proportion, all which I will leave to your discretion, but for Ladles to load at once, ought to be seven Calibers and a half, besides the coverture of the Button, and as all others are, *viz.* Two Calibers in bredth. Saker-Ladles.

But if the Peece be so great, that we cannot charge at twise without difficulty, then we may make the Ladle in that forme,

that

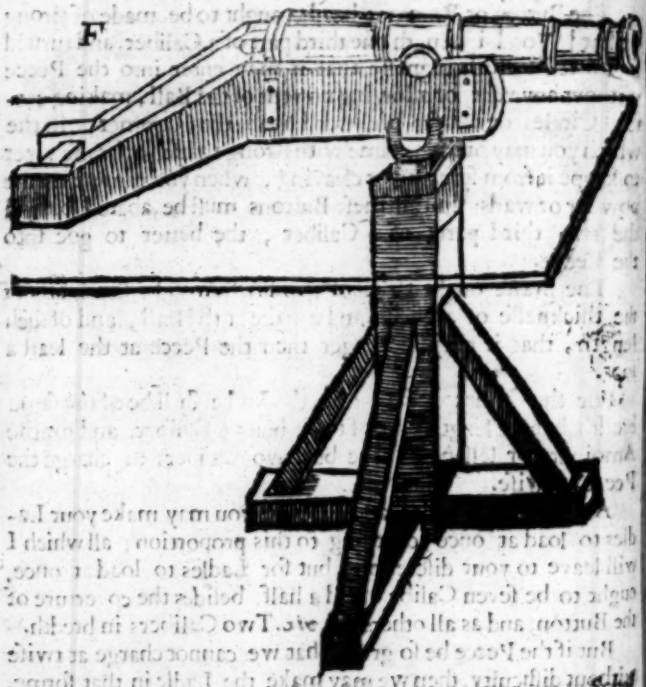
A Ladle to load at three times.

that we may charge at three times, in such sort, that in the place of foure Calibers, we may take 2 ⅓ which will make the same charge at three times, and the foure will make at twise, and for the double Cannon, that we cannot well charge at twise, we may make our Ladles to charge it at three times.

Perior-Ladles.

For Periors, which most commonly are but half the Caliber of the mouth in the Chamber, we may give the Ladles three Calibers of the Chamber in length, but those within the Chamber are two third parts of the mouth we may give 2⅓ length of the Ladle.

The peece mounted and fitted for service, &c.



As it is at large described in F, page 38. with its severall parts for the making thereof.

Schol.

Schol. I pray you shew me what course is to be used in the making of Cartriges as well of Canvas as of Paper?

Gun. For your Cartriges that are to be made of Cloth, you must cut your Cloth 4 Balls in length, and 3 in bredth, and leave a part for the Seame in the bredth, of a matter of half an inch, and likewise roome for the Seam both below and above, for the Cover and Bottom; but some doe onely bind both those ends with Twine, and when they put in the Cartrige to Charge the Peece, they unbind the mouth or end of the Cartrige, and put that open end first into the Peece, putting it home with the Rammer close to the Breech, and then lade the Peece. Making of Cartridges of Cloth.

But for Paper Cartriges, from a Demy-Culvering downward, you must have for every sort of Peece a Firmer turned for the same; whether it be DemiCulvering, Saker, or Minion, or otherwise, then upon these Firmers fitted to the severall Peeces; you must take Royall-Paper and role it about the Firmer, and so then paste it together with paste, or starch, and also the bottom to the same; and then take it off from the Firmer, and so let it dry till you have occasion to use them, and these are to be filled according to the discretion of the Gunner, about foure Balls in length, and this may suffice, both for Cloth and Paper Cartriges. Paepr Cartridges,

Schol. I think the next thing to be considered would be the Powder; I pray shew me how I might know and choose good Powder?

Gun. You say well, for after we know the Peece, and the manner how to Charge the same; it is fit to know with what, and that is Powder; which being so chief and speciall a thing, without which, a Peece of Ordnance were of no use, I will briefly deliver my knowledge therein. Chosing of Powder.

There was in ancient time a kind of Powder called Serpentine-Powder; why it was so called I need not here declare; this powder being the first, was made in a small kind of dust like meale, and was but of a weak receipt in comparison of that we now use, and neither was it corned as our Powder that we use in these dayes, for which cause, though it were then but Note this

A Ladle to load at three times.

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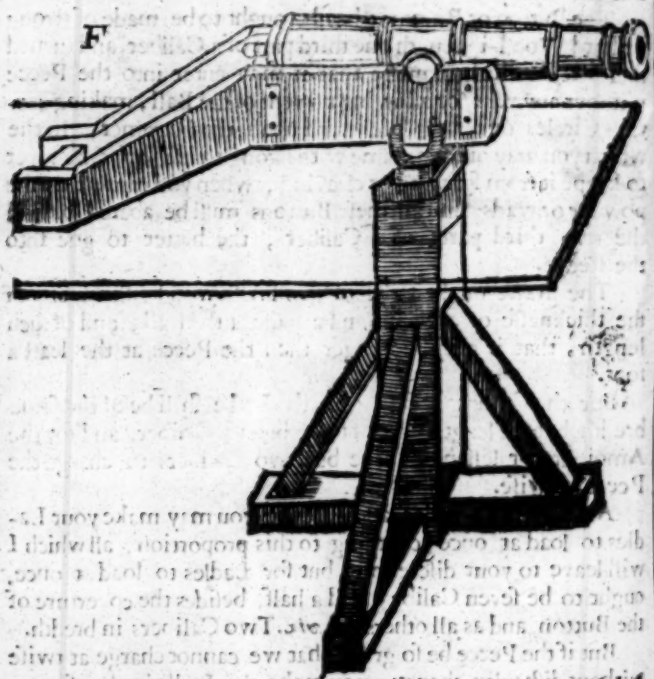

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weake and now the ſtrength in a manner doubled, yet the rule for Ladles, and Cartridges, do continue for the quantity of the Charge of the Peece as formerly or at the firſt they did; which is the cauſe of ſo much miſtaking as many times commeth to paſſe with Gunners at this day, for I dare ſay, that a pound of the powder which is now in uſe, will be, and is as ſtrong as two pound of the old Serpentine Powder, that was made a hundred yeere agoe, which thing not well conſidered, cauſeth the Gunners to commit much error.

But as cõcerning the choice of Powder, know that it is known by Colour, Taſte, and Burning; if it be a blewiſh colour inclining to red, it is good; if you put downe your hand into the Barell, or take there of in your hand, if it do not black much your hand it is a good ſigne; Alſo if it have a ſharp biting Taſte upon the Tongue it is good; but if it be inclined to moyſture, and doe give in the Barrel, and have a whitiſh matter, and ſomewhat Blewiſh, it is a ſigne that the Sulpher is not well fined.

Proofe of powder as is uſed in the Tower.

But the chiefeſt way to know Powder is by the firing, as thus; When you have many Barills delivered you out of the Arſenall, let them be weighed, and the heads of 6 of them taken off, you muſt have in a readineſſe 6 ſmall meaſures of Tinne, and thruſting your hand with one of them, as it were into the midſt of the Barrell; bring up the ſaid little meaſure full, which will contayne about 2 Drams, then lay on the head of that Barrell, and ſo go to the next, leaving the ſaid meaſure upon that Barrill, and till you have paced to the ſaid 6 Barrels, leaving the ſaid Tinne meaſures filled with the Powder, that you took out of every Barrill, theſe meaſures being numbred with 1. 2. 3. and ſo to 6, and with a piece of Chalk ſet the ſame number upon the Barill head, then go to ſome other place or convenient room in the Arſenall for that purpoſe, and make upon a bord 6 roundells with Chalk, and put the numbers 1. 2. 3. to 6, by every roundell, then take every meaſure; that which is numbred 1, into the roundell numbred with one, and ſo of the reſt; then fire each roundell by it ſelfe, and marke how it burns, for the whole Barrill out of which it was taken, is of the ſame kind, and if it burn with a ſudden flaſh, it is good, if it leave little

or no droſſe behind upon the bord; but if it burn with lights or ſparks, riſing up and falling down again, like a ſpark upon the bord, it is not good, nor well beaten or wrought, if there remain certain whitiſh Grains, it is a ſigne of much ſalt in it; but if Rediſh remain or Tawny the fault is in the coles.

Schol. Now the Peece being provided of all her neceſſaries, as Ladles, Spunges, Powder, Shot, and all other things; I think if you pleaſe, it were fit to ſpeak of the Cariages; I pray how are the Carriages to be made by proportion, for though it be the work of a Carpenter, yet I think he is to be directed by the Gunner?

Gun. You ſay well, and therefore it is fit to ſhow the making of the ſame, beginning with the Carriage of a Cannon by which you may know all other.

Every planck for the ſides ought to be 24 Calibers in length, of the Peece that muſt be lodged in the ſame, which is the common proportion according to the rule, that is to ſay ⅓ more then the length of the Peece; and one Caliber in thickneſſe, 4 Calibers broad in the head, and at the crook or bending which ſome call the Couch or Bed, 3 Calibers ½, at the Tayle 2 ½ and ſome play to be allowed for the Peece on each ſide between the two Planks. Making of Carriages.

The Traverſe muſt be 1½ Caliber in bredth, and a Caliber in thickneſſe; But that at the Tayle muſt be 2 Calibers in breadth, and 5 in length, to enter into each ſide of the planks ½ a Caliber, and this Tayle Traverſe muſt have a round hole lined with Iron, to paſſe thorow the pin of the Avantrine, and without a ring of Iron, to which a Cord may be faſtened when need ſhall require.

Of each ſide of this Traverſe ſhall paſſe two bolts of Iron through both ſides of the Plancks, or ſides of the Carriage, and them to be ſtrongly rivited and made ſo faſt as if it were one intire piece.

The Traverſe in the middle, at the crook of the Carriage to be 4 Calibers in length, and for the Tenents to enter into the Carriage to be half a Caliber, leaving the wideneſſe there to be 3 Calibers, and the ſame as at the Tayle to bolt through

all with two ſtrong bolts of Iron, that it may be ſtrong to hold the Breech of the Peece when it is liſted or coyned up.

But the Traverſe at the head to be 3 Calibers ½ in length, in ſuch ſort, that leaving half a Caliber on each ſide to enter into the Planks or ſides of the Carriage, ſo leaving the wideneſſe there, 2 Calibers ½, now by meanes of theſe Traverſes the Carriage is made ſtrong and as it were one body, and being well bolted and plated with Iron; will be able to indure the vehemency of the Shot of the Peece. And here you ſee the Carriage in his perfection, which muſt be armed with Extre and Wheeles, that it may be able to beare the weight of the Peece for the which it muſt ſerve.

Schol. Sir I pray you, ſeeing theſe things are ſo needfull to be known, that you would proceed to the reſt, and omit no one thing in the proportion as well for this Cannon Carriage as the other leſſer Peeces?

Gun. I will do my beſt, becauſe you are ſo willing to be inſtructed and therefore marke the proportions following.

The Wheeles muſt be as high as half the length of the Peece, the Rings or out-moſt circles of theſe Wheeles to be of good Wood, being made of 6 pieces every one being in length 4 Calibers and $\frac{1}{12}$ and one Caliber in height and one in thickneſſe, making the whole Circumference of the Wheeles as this ſheweth, The Cube or Nave to be in thickneſſe 3 Calibers, and in length 3. Calibers $\frac{1}{12}$, and ſtrengthened with two Iron hoops both before and behind, theſe to be faſtned ſtrongly with Brads that they hold faſt.

Note wel theſe proportions for Carriages.

The Spokes in each Wheele to be 12 in number, and in length 3 Calibers in ſuch ſort, that entring $\frac{1}{12}$ a Caliber into the Nave, and $\frac{1}{12}$ a Caliber into the Ring, the reſt of the length will be 2 Calibers, let the joynts of the Rings be covered or plated with 6 Plates of Iron being the $\frac{1}{12}$ of a Caliber in thickneſſe and $\frac{1}{12}$ in length; and let them be well faſtned with great ſpikes or Bolts of Iron, well rivited and clenched on the other ſide, that they may ſtrongly hold the joynts of the Wheeles together, and let the other plates that compaſſe the Wheeles Rings, be made according to the thickneſſe of the Rings.

Let the Extre be 8 Calibers and $\frac{1}{12}$ in length, and in the middle

dle one Caliber and ⅓ in thickneſſe, and the Arme to be one Caliber in thickneſſe, and at the end let it be ⅔, and the place where it is let into the Carriage, halfe a Caliber in bredth, and in height 1 Caliber and ⅓. And let this ſuffice for the Cannon, and Demi-Cannon.

Schol. I pray you let me know if there be any rules for the other peeces for making Cariages, as whole Culverings, demy-Culvering, Saker, and the reſt.

Gun. Surely he that doth well conſider this courſe may by this know the reſt, and I would not have a man ſo dull as to conceive no more then is beaten into his head, yet I will as neer as I can ſatisfy your requeſt for the Culvering, Demi-Culvering, and Saker; let the planks or ſides be in thickneſſe one Caliber of the Peece, and in depth at the head to be 4 Calibers; and at the Couch 3 Calibers ½, and at the Tayle 2 Calibers ½, the Tayl tranſum to be made according to the wideneſſe of the Peece at the Tronions of the Peece, and the Baſe Ring, and the Diſtance of the midle Tranſum from the Tronions, to be ſuch as that the Carnous or knob at the breech may fall within the ſaid midle tranſum, for I have ſeen many Cariages made that the ſaid knob or button of the Carnous hath ſtaid or reſted upō the Tranſum, & by that meanes you cannot raiſe the peece to the greateſt Randon that the Carriage will beare; Let the Tayle Tranſum be of ſuch wideneſſe, as the wideneſſe of the head and midle Tranſum will direct; let the Tronion wayes, that is the place of the Carriage where the Tronions of the Peece are to be let in, be placed ⅔ of a Caliber before the Extre, or as all comes to one, the Extre placed ⅓ of a Caliber behind the Tronion wayes, that the Carriage being fitted to the Peece in this manner, is to be bolted with two Iron bolts thorow all; that is to ſay, two bolts at the Tayle, and two thorow the midle Tranſum, and one at the head Tranſum, in the midle of the Tayle Tranſum, let there be a hole of 2 inches or more, in wideneſſe to receive a bolt, whereupon may be faſtened an Extre and a payre of Wheeles to draw the Piece into the Field when need ſhall require; but in Forts this may be ſpared.

By this that hath been ſaid may the other be known.

Mark here the proportion of Carriages.

Note this.

This is for Field Ordnance.

The ſaid Carriage thus prepared, is to be ſtrengthened and bound with plates of Iron work, the meaſures of which you

The names of the Iron work of the Carriage.

may ſee in the deſcription of the Carriage of the Cannon that is to ſay, two plates at the Tayle called Tayle plates, two at the head of the Carriage called Head plates, and two to faſten or hold in the Extre called Extre plates, and two at the Tronions called Capſquiers, with Staples, Forlocks, & riviting plates, for to rivit-ing of the ends of the bolts; and now is your Carriage ready for Extre and Wheeles.

The proportion of the Extre, and Wheeles.

Let the Extre be 6 foot in length, and one Caliber $\frac{1}{7}$ in thickneſſe in the midle, and ſo fitted that the Wheeles may be 5 foot a ſunder, let the Wheeles be in height halfe the length of the Peece, the Villows or Rings of good Wood, of 6 pieces well joyned and cramped with Iron, to ſtrengthen the ſame; the bredth and the thickneſſe of the ſaid Rings to be a Caliber, the Naves to be three Calibers thick, and 3 Calibers and a half long; the Wheeles to be finiſhed with 12 Spokes, placed by couples, the Naves to be hooped with Iron at both ends, which muſt be faſtened well with Braſſe, and thus the Carriage is ready to receive the Peece.

Schol. I ſee by this direction that we ought to be carefull in the making of the Carriages for all ſorts of Peeces; but ſeeing this doth chiefly belong to the Carpenter and the Smith; I think the Gunner need to do no more but give direction how they muſt be made, and to ſee when they be well made is enough for a Gunner; nevertheleſſe, I would be glad to know how to give directions for the making of all kind of Carriages, if need bee.

Gun. If you do but mark what I have formerly ſpoken of the Carriages, you cannot chooſe but ſoon do this; for firſt, you muſt number all your Peeces. *viz.* Set numbers upon every one, which numbers muſt be Cut, or Graven upon the Knob or Button at the end of the Carnous, as thus; Saker number (1) Saker numbe 2. Demi-Culvering number 1. Demi-Culvering number 2. Culvering number 1. number 2. and ſo as many Peeces as you have of one ſort let them be thus numbred, beginning at one, whether it be Falcon, Minion, Saker, or any other Peeces; as many Peeces as you have of one ſort, ſo number them as if you have 6 Demi-Culverings, then number the Demi-Culverings, 1-2-3-4-5-6, and ſo of all other Peeces, of

Mark this well for by this numbering of the Peeces is a great benefit to a Gunner.

what

what ſort ſoever they be, and although this thing be little regarded, yet it is in great uſe in place where is ſtore of Gunnes either by Sea, or Land; And therefore, whoſoever is Mr. Gunner, either by Sea, or Land; let him take this courſe, and he ſhall not repent him of his paines; Then for making of the Carriages, ſuppoſe the Demi-Culvering number 3. is 4 inches & a half in the Caliber, in length the Peece is 10 foot, the thickneſſe of the metall at the Tronions is 13 inches from the Tronion to the Baſe-Ring, 5 foot and a half, from the Baſe-Ring to the Knob or Button of the Carnouſe, 15 inches, the height of the Baſe-Ring 17 inches. and by theſe meaſures, your Carpenter may make all manner of Carriages, and if the Mr. Gunner do make him a Table of theſe meaſures of his Peeces, he ſhall do well, and it would be time well ſpent, and once done, will alwayes be ready at hand.

Not this well for the Carpinter.

Schol. I will make much of this direction, for ſometimes Peeces may be altered from one Platform to another, or carried from place to place; and yet the numbers will never let them be forgotten, for this once done, and ever done; and therefore when I have a little leyſure, I will ſurely make me a Table of all the Ordnance in our Coſtle, obſerving this rule; For a man cannot tell how ſoon he may have occaſion to uſe it. I pray you what is next?

Gun. The next thing in order as I take it, is the mounting of the Peece in her Carriage, which requireth an Engin called a Crowfoot-Ginne the handling of which is very uſefull and neceſſary for all Gunners to know, and acquaint himſelf therewith; as for the making thereof, you may find in other Author; and in eſpecially in *Vſano* of the practice of great Artilery in the 8 *Chap.* of the 3 *Tractate*, with the manner of the working, to which I referre you, and wiſh you to mark well the courſe there deſcribed for the mounting of a Peece, and this is very fit to be known to all Gunners that take charge.

Mark therefore how the Ginne is ordered in ſetting it faſt from ſliding, and how the Rope is put into the ſhivers of the Block or Ram-head, and how it muſt be faſtned to the Peece, and for the placing the Ginue right over the Peece, that it ſway not

Mark well the ordering of the Ginne.

not on any ſide, and the manner of the winding the Role, with the Levers, all which when the Peece is raiſed from the ground and hang in the tackling ſo high, that you may runne under the Carriage; let her then fall into the Tronion wayes of the Carriage, and then runne her upon the Plat-forme where ſhe muſt ſtand.

Schol. Sir, I have conſidered the foreſaid Author, and alſo read divers other works of other men, and the draught, and the deſcription of the Ginne with all his furniture, and alſo two other Engines, the one called a Racke, and the other Treſtle, but the uſe of theſe two latter, I know not; and as for the handling of the Ginne it is ſo difficult, that few men that are Gunners do know how to ſet it a work; But I will as occaſion ſerve, bend my mind to underſtand the ſame more fully; but I pray you in the mean time, declare to me the uſe of the Racke and the Treſtle, becauſe I have not hitherto been acquainted therewith?

Note here the uſe of the Racke.

Gun. For the Racke you ſee it is a work of Iron placed in a ſtrong piece of Wood, which Engine being placed under a Peece of Ordnance, or under the Wheeles of a Wagon or the like, will liſt up the whole ſide of the Wagon or Peece with the ſtrength of one man in winding the Winch and by help of this Engine you may ſet props or blocks, under the Peece, and amend any Wheele or Extre, or any thing belonging to a Peece; and this is a moſt excellent Inſtrument to be uſed in time of quick ſervice about a Peece of Ordnance.

Treſle of great uſe in a Fort.

But the Treſtle will beare a more heavy weight, although it be ſomewhat cumberſome; the making whereof you may find deſcribed in the ſaid Practice of Artillery, Chap. the 8, where it is well deſcribed with all his furniture and Meaſures; and theſe 2 Engines with the Ginne cannot well be wanting in any Fort or Hold whatſoever, to mount any Peece; to Extre the ſame, to turn the Wheeles; to Tarre or Tallow the Extre, and divers other things belonging, whereof the Gunner muſt be very carefull.

Schol. I ſee by this, that a man that will be a carefull man, may be a good husband for the King; in removing the Ordnance

nance from their long ſetled places, for want of which removing they ſtand and rot, and the Extres break for want of the turning the Wheeles, and tallowing the Extres, and the Platformes decay for want of keeping clean; all which is a hinderance to the King, a diſcredit to the Captain, and a foule ſhame for us Gunners, that ſpend ſo many idle ward-dayes, and do no ſervice about the Ordnance; But for mine own part, I will be hereafter more carefull then I have been, for thoſe plat-formes and Ordnance that I have in charge, and now I will apply my ſelf to uſe the Ginne, and thoſe other two Engines, the Racke and the Treſtle; but we have no ſuch as yet in our Fort.

A great negligence in idle and ſlothfull Gunners.

Gun. Then your Captain is to blame, and your Mr Gunner may be aſhamed, that he doth not inform the Captain of the want of ſuch neceſſary things, ſeeing theſe bee to be had if they be demanded in ſupplies as well as any thing elſe; but your Captain and Mr. Gunner both ſeeme to be, both ignorant and negligent, as may appeare by their ſlovenly keeping of the Ordnance and plat-forms, as I have often ſeen in divers of the Kings Forts; But now let us return to our former buſineſſe, for our Ordnance is now mounted.

Some Captains do ſcorne to be directed by the Maſter Gunner.

Schol. This admonition is not amiſſe, but now I pray you be pleaſed to goe forward to the next thing in order, which becauſe our Peeces bè in their Carriages, I think would be the plat-formes.

Of the ordering and making the Plat-formes in a Caſtle or Fort.

Gunner.

THe Platformes are to be well conſidered in a Caſtle or Fort, without the which, a man cannot make a good or perfect ſhot, and a man had as good have no peeces, as to do no good with them when we have them; for ſeeing, that in the reverſe of the Peece, which is juſt at the inſtant that the powder taketh fire, then by meanes of the force of the powder, the weight of the ſhot, and the ſtraightneſſe of the wads, the peece is removed before the Shot or Ball is out of the peece, by which meanes the

The Platforme a ſpeciall thing.

Gunner is often deceived and makes a bad ſhot, becauſe the peeces do not equally reverſe, and therefore Platformes are of great uſe.

Stone Platforms the beſt.

Schol. Before you proceed any further, I pray you reſolve me of this queſtion, whether Timber or ſtone be fitteſt to make the Plat-formes, for I have heard much diſpute amongſt Artſmen about the ſame?

Gun. I have ſerved with both Timber and Stone Plat-forms and do certainly know, that Stone Plat-formes are more ſerviceable and cheaper then Timber, and the Stone Plat-formes are farre more durable, and will out-laſt 10 Timber Plat-forms with a very little repairing, I ſpeak of Plat-formes in Forts or Holds.

Schol. What reaſons can you aledge to prove whether Stone or the Timber Plat-formes are beſt?

Gun. My reaſons are theſe, firſt I have known Timber Platforms to warpe, and become uneven by meanes of the heat of the Sun and the wet weather, and in wet and rainy weather to be ſo ſlippery that a man cannot ſtand upon the ſame; Alſo they are more chargeable then ſtone Plat-formes, and yet will not indure ſo long, for every 15 yeeres they do decay and muſt be new made, for I have obſerved in my time in *Dover* Caſtle in the ſpace of 30 yeeres the Platformes hath coſt 349.l. and more, being twiſe made in 30 yeeres, which Platformes were laid all charges born, for eight pence a foot; now for your Plat-formes that were made in the ſaid Caſtle, when thoſe Timber Platformes were decayed, were layed, all charges born, for 5.d. half peny and do continue well, with little reparations and like to continue time out of mind, and are much better for ſervice.

Stone Platforms beſt and eaſieſt.

Schol. I did not think there had been ſo great difference in the charge between Timber and Stone, neither did I conceive that the charge had been ſo great to the King; for if the Plat-formes in *Dover* Caſtle coſt 349.l. in 30 yeeres, what a ſumme of Money will it require in all the Forts in *England*; But now I pray you let me underſtand how theſe Plat-formes are to be ordered according to the bredth and length of the ſame, and what diſtance is to be kept between one Peece from another, as need ſhall require?

Gun-

Gun. Concerning the Plat-forms in Caſtles and Forts, you muſt make them at leaſt 17 foot in bredth, whether they be Timber or Stone, and in that ſpace the Wheeles and the tayle of the Carriage will well ſtand upon the Plat-forme, and let the Plat-forme be higher behind then it is before, by 4 Inches, that is, let it better 4 inches in ſeventeen foot, which is done for the eaſe of the Gunners in bringing their peeces up again to their places; as alſo to checke the reverſe of the Peeces, but let it not be above 4 inches in ſeventeen foot; for I have ſeen ſome Plat-formes to be ſo high behind, that the peeces have runne forward of themſelves, and the Gunners muſt then put them back before he can load againe.

Mark the bredth and length of the Plat-form.

Now for the length of the Plat-forme, let it be according to the number of the Peeces that you mean to place upon the ſame, keeping the diſtance of 6 foot, or at the leaſt 5 foot between Wheele and Wheele; as if you will place 10 Peeces upon a Plat-forme, you muſt make your Plat-forme 110 foot long, and let it be no higher at one end, then at another; and this courſe is ſufficient to be obſerved in all Forts, both for Stone and Timber Plat-formes; where the Ordnance ſhall remaine conſtantly in one place.

Five foot between one Wheele from another.

Schol. I pray you reſolve me of two things; and that is, whether a peece will carry further when ſhe doth not reverſe, then when ſhe doth reverſe; the other queſtion is whether a Peece of Ordnance may be ſo ordered that ſhe may not reverſe any thing at all?

A ſpeciall Queſtion.

Gun. You have moved two queſtions of great conſequence, and in this, a way to ſpare both Wheeles and Platformes; and as you ſaid before, what a great ſumme of Money would this amount unto in all the Forts in *England*; now what do you think of a man that ſhould perform theſe two things, that is, to order a Peece in ſuch ſort that ſhe ſhall not reverſe, and alſo to ſpare the charge of Wheeles and Plat-formes?

Let the State well conſider this thing.

But amongſt ſome other things which it pleaſed his Majeſty to queſtion me concerning the Ordnance in our Fort, it was his pleaſure to queſtion me about the diſtance of a ſmall Barque lying at an Anker in the rode, which I ſhewed his Majeſty, to take with a plain paire of Compaſſes, and a ſcale which I

I ſhewed the Kings Majeſty a rule to take a diſtance.

carried about me in my pocket, but doubting of the truth of this ſo eaſie a rule, he called an excellent Mathematician, to whom I ſhewed the ground of the propoſition, and he affirmed it for a truth to his Majeſty, and at that time I moved his Majeſty with this my deviſe, in uſing all manner of Ordnance without Wheeles and Plat-forms, who liked ſo well of the deviſe, that he did ask me if I had ever tryed the ſame, and I anſwered yes, I had tryed it; he askd me with what Peeces, I ſaid with a Falcon, a Saker, and a Demi-Culvering; he asked me if it hold in a Demi-Culvering well, and I anſwered, it did hold beſt in the weightieſt Peeces; he ſaid he would have it tryed in a whole Culvering, and a Demi-Cannon, when he came to *London*; I prayed his Majeſty that becauſe it was my deviſe, that I might try it my ſelf, he ſaid he would ſend for me when he came to *London*; But his Majeſty never was there ſince, nor I was never ſent for; there paſſed ſome other concluſions, which I propounded to his Majeſty concerning Ordnance; and for this favour I am bound to pray for his Majeſty alwayes.

My ſpeech with his Majeſty concerning the ordering of Ordnance without wheels or Plat-formes.

Schol. You ſay well, but yet I pray you returne from whence you have digreſſed and anſwer my queſtion, that is, whether a Peece will carry further when ſhe doth not reverſe, then that peece will do that doth reverſe?

Gun. This is eaſily anſwered, for it is moſt certain, that a Peece that doth not reverſe will much out-ſhoot a Peece that doth reverſe; as I have tryed often times; but in the yeere 1610, I was to ſhoot 3 Demi-Culverings to the Pole in the Sea, from the ſquare Platforme, the Pole or moule Rod being diſtant from the Peeces or Plat-forme 50 Score, the peeces had 3 degrees by the Quadrant; and two of theſe peeces were upon Wheeles, the other lay in her Carriage upon the ground, and could not reverſe, but out ſhot the other two above 40 yards; and divers other experiments I have often proved to this effect and therefore you may boldly ſay and affirme, that a Peece that cannot reverſe will out ſhoot a Peece that doth reverſe.

A Peeces that doth not reverſe, will out ſhoot a Peece that doth reverſe.

Schol. I do well ſee and allow this your experience, but now for this ſecond queſtion; whether a Peece of great Ordnance may be ſo handled or ordered that ſhe may not reverſe, and yet doas good or better ſervice then the other; Therefore declare openly

penly this ſaving courſe, which though it be not beneficial to you at this preſent, yet it may hereafter do you good; For the Parliament is wiſe and mercifull where they ſee men wiſe and Induſtrious?

Gun. I have no doubt of the wiſdome and judicious carriage of the Honourable Court of Parliament; for I have heard that they have well rewarded many men well, that have diligently imployed themſelves for the good of their King and Country; but it may be ſome ignorant Gallant whoſe wit in his Tongue may carp at this my deviſe; but let it be what it will, I will indeavour to ſet down my opinion in as plain termes as I can, if you will mark it well; as concerning the uſe of a peece of Ordnance with out Wheeles and Plat-formes, by which courſe many a 1000. l. may be ſaved, and the Ordnance in Forts and Holds to be uſed more readier and quicker for ſervice (as thus.)

* I regard not the ill Tongues of fooles.

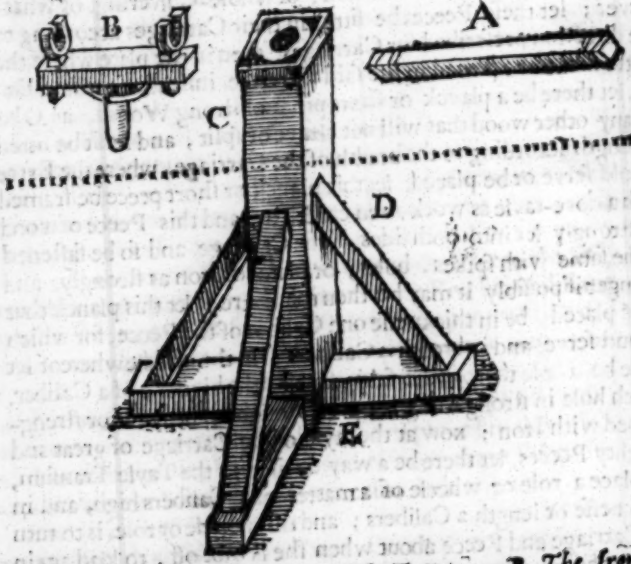
Let your peece of Ordnance of whatſoever kind it be, as Saker, Demi-Culvering, Demi-Cannon, or whole-Culvering, or whatſoever; let theſe Peeces be fitted in their Carriages according to the direction preſcribed for Carriages, then in the place where the Extre ſhould be placed in the ſaid Carriage, inſtead of the ſaid Extre, let there be a planck or ſhort piece of ſtrong Wood, as Oke or any other wood that will not cleave or ſplit, and let it be fitted in length according to the bredth of the Carriage, where the Extre ſhould ſerve or be placed, let this planck or ſhort peece be framed with a dove-tayle as work-men calleth it; and this Peece of wood be ſtrongly let into both ſides of the Carriage, and ſo be faſtened to the ſame with ſpikes, bolts, or plates of Iron as ſtrongly, and ſtronger if poſſibly it may be, then the Extre; let this planck thus to be placed, be in thickneſſe one Caliber of the Peece, for which it muſt ſerve, and in bredth 4 Calibers; in the middle whereof let there be a hole thorow the ſaid planck, the bigneſſe of a Caliber, which hole in ſtrong and great pieces, ought to be lyned or ſtrengthened with Iron; now at thetayle of the Carriage of great and weighty Peeces, let there be a way deviſed in the Tayle Tranſum, to place a role or wheele of a matter of 3 Calibers high, and in thickneſſe or length 2 Calibers; and this wheele or role, is to turn the Carriage and Peece about when ſhe is ſhot off, to load again within the rampire or Gabion; and thus is your Carriage fitted ready for the Peece and for ſervice.

The proſecution of the invention to uſe Peeces without wheeles and Platformes.

To Load the Peece within the Rampire.

Now for the foot or Spindle whereupon this Peece muſt ſtand and be ſhot off without any reverſe; take a piece of Tymber, bearing the ſquare of 3 Calibers, or ſuch a piece of Timber as a diſcreet work-man ſhall think fit; Let this piece of Timber be in length about 4 foot ½ or 5 foot, whereof three foot muſt be ſet into the ground, and a foot ½ above the ground; to beare the Carriage and Peece in time of uſe and ſervice; let this Peece of Wood or Spindle be left at the top with a round Tennant or pinne, of the bigneſſe of the hole in the plank or Tranſum before ſpecified. Now to make this Poſt or Spindle faſt into the ground, let it be referred to the diſcretion of the Carpenter or work-man that may contrive the ſame as he pleaſeth; yet I think this poſt were fit to be ſet into a foot or Groundſell of Timber, with three ſhores to keep the Peece ſteddy, that it moveth not when the Peece is diſcharged.

The faſtening of the Spindle left to the work-man.



A *The croſſe-peece in ſtead of the Extree.* B *The Iron whi*
his forke to beare the Carriage of the Peece. C *The Spindle or poſ*
to beare the Peece. D *The part of the Spindle or Poſt with his foo*
and braces to ſtand in the ground. E *The groundſell or foot.* The

Then place your Carriage upon the Spindle thus fitted, and by help of your Ginne, place the Peece into the Carriage, and ſo your Peece is fitted for moſt ready and excellent ſervice, upon any occaſion; and thus you may ſee the way to uſe any Peeces without Wheele and Plat-formes; and ſave an infinite charge, that is needleſly performed.

Schol. This is an excellent way if it take effect according to your expectation; but I fear and do certainly think it will never indure the reverſe of a great and weighty Peece of Ordnance, as a Cannon, or Demi-Cannon, or Culvering; but will break all, nevertheleſſe, this were well worthy the tryall, the charge whereof will not be great, conſidering the profit that may come thereof, and the excellent uſe that an ingenious Generall of the Ordnance may make thereof if it hold,

This thing worthy the tryall.

Gun. This doubt did alſo much trouble me, and was my fear, till I had tryed the ſame with a Demi-Culvering, and other ſmaller Peeces, as I ſaid before, and I do certainly affirme, that the Demi-Culvering, though but weakly ſet up after this manner, being at my own coſt, did ſtand and was uſed ſo above 4 yeeres, and might have continued longer in our Fort, but that our Platformes were new made; the tryall whereof was ſeen and well allowed by Sir *Albertus Morton*, and Collonel *Harwood*, in the yeere 1613. Alſo a Falcon in *Dover* Caſtle, and a Saker in *Deale*, which I think ſtands at this day.

The Peeces thus ſet up continued a long time.

Schol. Theſe are good ſufficient tryals, but till I may hear, or ſee the proof therof by ſome expert Souldier of good experience in the Warres, tryed in a Demi-Cannon or whole Culvering; for my part, I ſhall give no great credit to it; nevertheleſſe, you are to be commended, and rewarded for this your invention; for it may prove an excellent thing, both at Batteries and ſieges, as it may be uſed.

This is to be reſpected though it prove not as is expected.

Gun. I can but propound it, but I am well anſwered, that if the King my Maſter had not had theſe unhappy troubles; I ſhould have ſeen not only this, but alſo things of greater conſequence, to be put in Practice before this time, and as it falls out, I am glad that my other propoſitions take no effect, for I ſee too much practiſe already, to deſtroy men; and therefore, I think it better to learn to defend then to offend, and therefore, I hold it more fit to impor-

It is better to defend our ſelves then to deſtroy our Enemies.

importune our good God by faithfull prayer for the happy union of his Majeſty and his judicious Parliament, then to ſtudy any new devices to deſtroy our friends.

Schol. This charitable conſtruction is commendable, but I pray you go forward with this your deviſe, if there be any other thing to be obſerved in this thing; for the courſe being ſo eaſie, both in the charge of the materials and eaſe of the Gunners, is ſo excellent, that yet I doubt of the performance thereof, and fear that ſome one thing or other may faile, and my chiefeſt doubt is, that if there ſhould be any ſtore of Peeces placed together, and well plyed, and the Ordnance great, as Cannon, Demi-Cannon, and whole-Culvering; they will ſo ſtraine the Carriages, and the work of the poſts or ſpindles (as you call them) and ſo ſhake the earth, that in time they will grow looſe, and ſo of no uſe.

Whether this will hold in in many Peeces placed together.

Gun. Theſe your doubts carry ſome colour, and depend upon good reaſon, and as for the tryall that I have made, was but in a Falcon, a Saker, and a Demi-Culvering, all which continued ſtrong and ſervicable about 5 yeere, till theſe Peeces were taken down to make new Plat-formes; But thus much I think, that an ingenious Carpenter may ſo order this work, that the Peeces of what weight or number, they may be made ſo ſtrong and faſt in the ground, that they can in no wiſe be ſhaken or grow looſe; and thus I leave this to the diſcretion of the wiſe and judicious Generall of the Ordnance, to be practiſed if he pleaſe, for the profit that may come thereof, may certainly countervaile the charge of this tryall.

Of the manner of Lading your Ordnance and the direction belonging to the ſame.

Scholler.

SIR, in our laſt conference you ordered to ſpeak of the loading of Ordnance, and I remember you ſaid it muſt be comly and nimbly performed; a thing which I have hitherto made little regard of, thinking it no great matter to charge a Peece; but becauſe I ſee you make good account and reckoning thereof, I will bend my mind to know and exerciſe the ſame; therefore I pray you for memories ſake give me ſome directions?

Little regard of ſome Gunners about loading their Peeces.

Gun.

Gun. Do you say you have so slighted this commendable quality of loading your Ordnance, then I would have you consider that as it is the grace and commendation of a Souldier that handleth a small shot or a Musket, to do and perform his postures orderly and comely, so much more in a Peece of great Ordnance, for a Gunner to exercise the comely and nimble ordering himself in charging and discharging his Ordnance, as I my self have seene the Gunners both in *England*, in *Germany*, and the low Countries, being a great pleasure to behold and a great and excellent commendation for the Gunner, when he shall handle his Ladle, and order all things quickly and nimbly before his Prince, or his Generall; let the Gunner therefore indeavour to set forth himself, with as comely a posture and grace, as he can possible, for the agility and comely carriage of a man in handling his Ladle, Spunge, and lading his Peece is such an outward action as doth give great content to the standers by.

A great commendation for a Gunner to load his Peece with a comely posture.

These things considered, I will now shew you certain words of direction for your memory sake.

Suppose you are to lade 2, 3, or 4 Peeces, and that you are come to your Plat-form, your Peeces being in their places put up unladen; And first you must understand that to handle your Ordnance, you ought to have 3 men at least, but to greater Peeces more men, as the weightinesse of the Peeces shall require; but to any small Peece you are to be allowed three men, one to handle the Ladle and Spunge, and the two other to provide wad and shot and to hold the budge-barill, and to serve with their hand spikes at all occasions when they are commanded observing this order.

Words of direction to load a Peece.

First, let your two labourers or assistants be appointed to serve the one at the right hand, the other at the left; and neither of them to remove into the others place till the Peece be charged.

Let your right hand man bring your Ladle and your Spunge, and place them on the right side of the Peece, between the Wheele and the Carriage, and stand you on the same right side, then let him provide a fit shot for the Peece and lay it ready, let your left hand man provide two wads of Ocam, ozhay, or straw, and wind them up round, and light and place them between the spokes of the Wheeles that the wind blow them not away, and then let him fetch the budge-barill with powder, then to lay your peece to passe to

The right hand man and left hand man.

load, let your two assistants one on the right side, the other at the left, be ready with their levers to presse up the Peece to discharge the Coyne, and stand you with one leg within the Cariage, and the other without, but not both legs within the Carriage, for that is unseemly, and a forfeit which the Gunners may challenge of any stranger that doth so; well the Coyne being discharged, draw it back so that the Peece may lye levell, or a little higher at the mouth then at the breech, then your Peece being put back, which must first be done, is ordered to load.

Ordering of a Peece to load.

Then comely and gracefully take up your Ladle and put it into the Peece, and turn and move it too and fro, to search if there be any Stones or gravell in the same, that you may bring it out with your Ladle, and so cleere the Peece, and when you have well cleered the same from Stones and gravell with your Ladle, set by your ladle in his place, take your Spunge in comely manner like a souldier, and Spunge well your Peece.

Filling the Ladle.

Then let your left hand man bring the budge-barill with the powder, and hold it up as high as his knee or waste, steeping the same, holding one hand under the Lether to keep the powder that it scatter not lea st any be lost, then thrust in your Ladle and fill the same at 2 or 3 proffers, your Ladle thus filled, let your assistant with his hand strike off the loose powder.

Then with a steddy hand put your Ladle with the powder into the Peece, keeping the the thumb of your left hand close to the peece, put in your Ladle with powder at three motions, and alwayes carrying a steddy eye upon the Ladle staffe, as you put it in, that in no wise it may turn aside, till you feele the Ladle stop at the end of the Chamber.

Emptying the Ladle.

Then fix your thumb of your right hand on the upperside of the Ladle staffe, and empty your Ladle cleane, by turning your thumb that you fixed on the upperside, with the Ladle staffe, till your thumb and staffe that was uppermost before, is now undermost; and so your Ladle shall be clean emptyed, then withdraw your Ladle a foot, and shake the same so that no loose powder may remain behind in the Ladle, and the Ladle thus emptied, bring it gently out, and take heed you shame not your self in bringing some powder out again with the Ladle, which is imputed a great shame to a Gunner.

Your

Your Ladle thus emptyed, turn your Rammer head gracefully, and put home your powder easily and gently and the powder thus put up, withdraw your Rammer at three motions, the Rammer being out, if you lead but with one Ladle, let your left hand man be ready with a good stiffe wad, putting into the peece as farre as he can reach with his arme, then let your right hand man hold his finger upon the vent, and so with your Rammer put home your first wad, with a stroke or two, then as before, withdraw your rammer again at three motions, then when it is out, let your right hand mate put in the shot, being first regarded and well viewed lest it be not fit for the Peece, or too high or too low, or not round and not knotty or craggy, for such a shot too high may cloy the Peece and not go home to the wad, and so danger the breaking of the Peece. also a shot too low will never go right to the mark, but will be either wide or short, but by reason of the play that it hath in the Peece may prove stark naught. and note that a quarter of an inch vent is alwayes fit to be allowed in a Peece, be it great or small, your shot being put in, it may be will roll down, but do not trust to that, but feele it gently home with your Rammer head, and beware of any swift motion, lest you strike fire and so marre all.

Put home your Powder.

Regard your shot

Your shot being home, let your left hand mate put in your last wad, as before which you may boldly and strongly put up, and when you feele it home, give it a good strokes with the Rammer head, then Gage your Peece to see if all be well, then run up your Peece and lay her water-borne. and thus in as brief a manner as I can, I have shewed you the order of loading or the charging of a Peece of Ordnance.

Gage your Peece.

Schol. I see well there are many things requisit in charging of a Peece, and that Gunners should do well often to practice and exercise the same, this being a thing as fit to be practised in great Ordnance as it is in small shot, and as it is a commendable thing in a Musketier to handle his Peece and do his postures comely and with a grace, so it is a most commendable thing in a Gunner to go quickly and nimbly about loading his Peece, and I see no reason but at ward-dayes we should be enjoyned to make it our chiefest exercise if we had any man that did know this thing, or would take any paines in this principall service of the Ordnance, for this may well be all practised without powder or other things, only by

Gunners in their ward dayes to be practising to load their peeces without powder.

making proffers with empty Ladles, empty Budge-barrils, and empty Peeces, and this may make us ready for service in time of haste and need.

Divers great mischances in loading of Peeces.

I have seen in this businesse in charging of Ordnance a great neglect and disorder, some never looking after that, that there should be some fayling in filling the Ladle, scattering their powder, some forgetting to wad, some putting in two wads instead of one, some two shot, with such like; But I will henceforth have a care, and for the shunning of this inconvenience, I will make bold for my better remembrance, to collect this your large discourse into some memorable words of direction in loading, or charging a Peece of Ordnance, which may serve instead of postures, as in small shot, as thus followeth.

Let these words of direction be well regarded.

1 Put back your Peece.
2 Order your Peece to Load,
3 Search your Peece,
4 Spunge your Peece;
5 Fill your Ladle.
6 Put in your Powder,
7 Empty your Ladle:
8 Put up your Powder,
9 Thrust home your wad,
10 Regard your shot.
11 Put home your shot gently,
12 Thrust home your last wad with three strokes.
13 Gage your Peece.

These are the things as I conceive belonging to the charging or loading of any Peece, and now I know them, I will indeavour to Practice them, at times convenient as I can; and now if you please to proceed to the next thing to be learned, for I think this is enough touching the loading of a Peece of Ordnance.

Gun. I much commend your forwardnesse, for by these words of direction you shall hardly forget any thing belonging to the loading of a Peece, for certainly even every one of these words, must be, and are used of every Gunner that doth charge a Peece, though not in order, and I could give you a good reason for every one of these, how they are used; but because I have explained them in my former speech, and considering your forwardnesse in this Practice, I leave you to your own course, and now in the next place speak somewhat of disparting your Peece, for now your Peece is mounted in her Carriage, brought upon her Platform,

Great reason for the words of direction in loading a Peece.

form and loaden, the next is to make a ſhot, which cannot be exactly done till the Peece be diſparted.

Of the manner and way to diſpart a Peece, and ſome other things concerning Gunners Inſtruments.

Sc. SIR, at our laſt conference after you had ſpoken of the loading of a Peece, I remember you ſpake of the diſpart; which is a word that I do not well underſtand, neither do I know the uſe of it, I pray you therefore declare it?

Gun. You ſee & know that a Peece of Ordnanee hath its chaſe or Cilender ſtraight, or as it were a ſtraight line, from the breech to the mouth, and this onely of all the parts of a Peece, is a ſtraight line, by which ſtraight line the ſhot is delivered to any mark, and becauſe you ſee in all Peeces of Ordnance, the mettal at the breech is greater then it is at the mouth; therefore the ſaid mettal muſt be brought to be parallel or equall to the Cilender or Chaſe of the Peece; for if it be not, when you ſhall take your ſight upon the mettal of the breech to the mettal of the mouth, and ſo to the mark, you muſt needs over-ſhoot the mark, if it be within levell of the Peece; and therefore the ſaid mettal at the breech and mouth, muſt be brought to be equall, that it may be parallel to the Chaſe or Cilender of the Peece, and this that I now ſpeake of, is done by cutting a little ſtick or ſtraw, of the length of that difference, and faſten it upon the Muſſel-Ring with wax or clay, and this is called the Diſpart.

The reaſon why Peeces are diſparted.

Schol. I have ſeen ſome Gunners, uſe the ſame, but I never did underſtand the reaſon till now, and becauſe I ſee by this your ſpeech that it is ſo neceſſary, that a man cannot make a perfect ſhot without it; I pray you ſhew me the beſt way to do it?

No perfect ſhot except the peece be diſparted.

Gun. There are divers wayes uſed amongſt Gunners to give the diſpart of a Peece; for ſome uſe a ſtring, ſome a two foot-rule, others uſe a priming-Iron, and many other things according to mens fancies; But becauſe you may find theſe wayes plentifully ſet down in other mens writings, I referre you to the ſame; and I will ſet you down the beſt way which I have alwayes uſed.

Divers wayes to diſpart a Peece.

Amongſt divers inſtruments uſed by Gunners, there is a payre of Compaſſes called Callipors, which be Compaſſes with crooked

points, which are or ought to be a foot or 16 Inches long, with which you muſt take the height of the mettal at the breech, and the height of the mettal at the mouth of any Peece, and half the difference of theſe two is the true diſpart of a Peece.

Schol. I have often ſeen of thoſe Compaſſes in Carpenters and Shipwrights hands, and if you pleaſe I will mak a tryall if I conceive your meaning.

Here is a Peece number 4 to be diſparted, I take my Calipers and I find the height of the Baſe-Ring to be 16 Inches, and that I note down upon the ſide of the Carriage, and in the firſt priſt ſet *A* and the other *B* then I go to the mouth and take the heig of the muſſel-ring, and that is 9 Inches, and my compaſſes remaining at that wideneſſe, I pitch one foot in *A*, and extend the oth towards *B*, and where that reacheth I make the point *C*. then take half the diſtance between *C* and *B* and that is the length of diſpart, to the which length I cut a little ſtick or other thing, a ſet it with wax or clay upon the higheſt mettal at the mouth, a ſo my Peece is diſparted. But now if I would know the length this diſpart in Inches, the Baſe-Ring being 16 Inches, and t muſſel-ring 9, take 9 out of 16, and 7 remain, the half of 7 is th Inches, this I note down in a Book for the true length of the Peec number 4 which being once, is alwayes don; and this being ſuffic ent for diſparting of all Peeces, I pray you let me know what In ſtruments do belong to a Gunner, to fit himſelf withall, upon a occaſions?

The practice to diſpart a Peece.

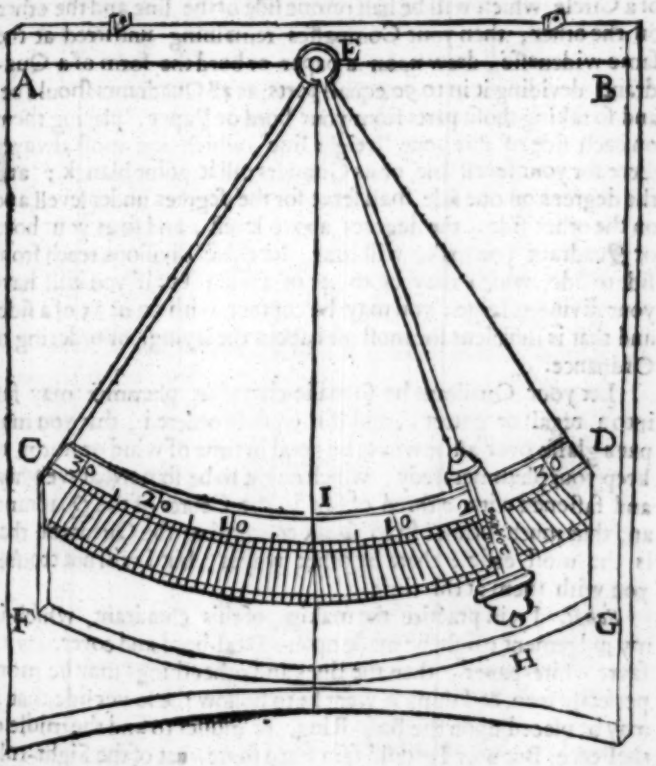
Gun. The chief and moſt neceſſary Inſtruments which belon to a Gunner, which he cannot want, is firſt a Quadrant. ſecondly a Sight-rule, 3ly. A payre of Compaſſes with crooked poin called Calipers, 4ly. A payre of ſtreight pointed Compaſſes, 5ly height bord to try and paſſe your ſhot thorrow, 6ly. A caſe of p ming Irons of all ſorts, 7ly. A Horn or two for priming powder, 8 A Steele-to ſtrike fire, 9ly. Two or three Linſtocks to give fire, a armed with Match, theſe things no Gunner can well be with o

The Inſtruments belonging to a Gunner.

Schol. It is no hard matter to have theſe alwayes in a rea neſſe, but I muſt confeſſe that ſome of them, I neither know the king nor the uſe of them; therefore, I pray you ſhew me the m ning and uſe of the Quadrant and Sight-rule, as for the other limbs can find out of my ſelfe, but I have ſeen much diverſity

these, I would therefore know which of them you like best, and are most fit for service?

Gun. You may see these Instruments well described in the books of M^r. *Bourne*, M^r. *Digges*, M^r. *Smith*, and in *Tartaglia* Englished by M^r. *Cyprian Lucar*, and others, especially the Quadrant which they appoint to slip on, upon a two foot Rule, and to be put into the mouth of a Peece; this they hold to be the ordinary course for using the Quadrant, but when a Peece lyeth over a Wall or a Rampier, it is very troublesome, and cannot exactly shew the degree, therefore I have thought upon another course to use a Qua-



drant

drant upon the mettal of a Peece, but then care muſt be taken that it may ſtand parallel to the Chaſe or Cilender of the Peece, which a diligent Gunner may well do if he take heed, and ſo the Quadrant may ſerve to very good uſe. But the beſt way, to make a Quadrant to uſe upon the mettal or out ſide of a Peece is this, prepare a bord of good Wood that will not warpe, in length 8 inches, and in bredth 5 inches, let it be tried very ſquare, and let it be ⅛ of an inch or ¼ thick, then in the longeſt ſide in the middle of the ſaid bord draw a ſtreight line, and at the upper end of that line make a priek for the Center, from that Center deſcribe the Arch of a Circle, which will be half on one ſide of the line, and the other on the other; then your Compaſſes remaining unſtirred at the ſame wideneſſe, draw upon a paper or bord the form of a Quadrant, deviding it in to 90 equall parts, as all Quadrants ſhould be, and ſo taking thoſe parts from your bord or Paper, placing them on each ſide of this your ſtreight line, which line muſt alwaye ſerve for your levell line, or as Gunners call it point blanck; and the degrees on one ſide ſhall ſerve for the degrees under levell, and on the other ſide, the degrees above levell, and ſo as your bord or Quadrant you make will bear, let thoſe diviſions reach from ſide to ſide, which may be to 45 of a ſide; but if you will have your diviſions large, you may be content with 30 or 25 of a ſide, and that is ſufficient for moſt uſes about the laying, or ordering of Ordnance.

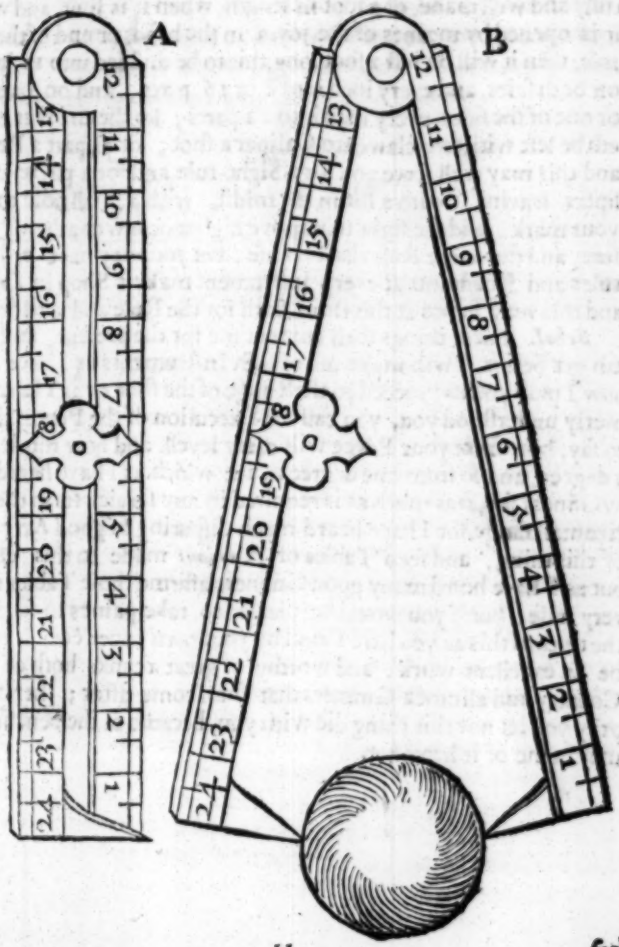
The making of the Gunners Quadrant.

Let your Quadrant be ſo made that your plummet may fall into a regall or gutter, and if it were ſo ordered, that you may put a glaſſe over all, it would be good in time of wind or ſtorm, to keep your plummet ſtedy, which ought to be ſomewhat weighty, and faſtened with a thred of ſilk in the Center of the Quadrant, and thus much I think fit to ſpeak concerning the Quadrant that is the moſt eaſie; there be other wayes, but I will not trouble you with them at this time.

A Glaſſe to put over the Quadrant to keep out the wind.

Schol. I will practice the making of this Quadrant, which in my judgement might be made upon a Deal-bord and covered with fayre white-paper, then the lines and other things may be more perfectly ſeen, & I think it were fit to hollow the lower ſide, that it may be placed upon the Baſe-Ring, or muſſel to find the midle of the Peece; But now I would fain learn ſomewhat of the Sight-rule,

A *The Sight-rule closed.*
B *The Sight-rule opened to the height of a Shot.*



such a Brasse rule as I have seen you use many times about your Ordnance.

Gun. This rule as you know is made of Brasse, and it ought to be truly and well made, of a foot in length, when it is shut, and when it is opened by meanes of the joynt in the head, or end of the said rule, then it will be just 2 foot long, this to be divided into 12 inches on both sides, and every inch into 8 or 16 parts, and on one part or one of the sides, every inch into 11 parts, let the end that openeth be left with two clawes to Caliper a shot, or dispart a Peece; and this may well serve you for a Sight-rule, and for a payre of Calipers, leaving it with a slit in the midst, with a small hole to espy your mark, and the sight to remove higher or lower at your pleasure, and this is the Rule that I do use, but you may have ordinary rules and *Quadrants* at every instrument makers Shop in *London*, and this may suffice at this time, both for the Rule and *Quadrant*.

The Sight rule to be made either of Brasse or Wood.

Schol. These things shall content me for the present, and till I can get better, I will make use of such Instruments as I have, and now I pray you to proceed to the Range of the shot, or as I have formerly understood you, you call the Execution of the Peece, that is to say, how farre your Peece will carry levell, and how much upon a degree, and so from one degree to 10, which as I have heard many Gūners say, is as much as is required in any service from the Horizontall range, for I have heard much disputing of good Arts-men of this thing, and seen Tables of *Randons* made to this effect, but as I have heard many good Gunners affirme those Tables to be very false, but if you would be pleased to take paines to set down the truth of this as you have found by your own experiēce; It would be an excellent work, and worthy of great thanks both of your Country and all other Gunners that shall come after; therefore I pray you let not this thing die with you, because of the benefit that may come of it hereafter.

Of the execution of a Peece.

An excellent work to set down the Range of the shot by experience.

Of

Of the Range or Execution of all Peeces, from a Falcon, to a whole Culvering; with three severall Ranges from one degree to ten, practised by manuall experience in the Castle of Dover, *and the Fort thereto adjoyning, with certain Tables very necessary to be known and practised by all true and diligent Gunners.*

Gunner.

YOu require of me a thing most necessary for Gunners to understand and all that which may be profitable for the Ages that shal come hereafter, and therefore laying aside all malice and envy which infecteth men in this malicious age; I will condescend to your request, and without any more circumstances, truly set down the meanes, and then the manner of my practice, as I have tryed by experience in his Majesties Castle of *Dover*, and some other places in the Cinque-Ports, wherein I have lived now this 50 yeares.

Schol. If you please to do so, then shall I not onely be beholding to you, but also your Country for succeeding times, this being a charitable deed, and worthy commendations of all men; for I do verily beleeve, that as you have taken pains in the study and practice of many other Arts, and profited well in the knowledge of the same; though they have left you little or no meanes in the world, yet I heard that in this Art also, you by meanes of your diligent practice and long experience, you are very perfect; therefore I pray you all indignities set aside, shew me how I may order my self to make a perfect shot in all Peeces at any serviceable distance; how farre a Peece will carry level, and what distance upon the mount of the degrees with the use of the Quadrant, and the Sight-Rule, and the proofes that you have made in all the time of your practice, with the use of the same, which though it be tedious unto you, yet by taking leisure, I hope you may well do?

A Charitable deed to declare the truth of the Art.

Gun. You have required of me a hard task, and a thing that I know not whether I may live to perform it; nevertheless, I will set about it, praying God to give a blessing to my faithfull endeavours, and now I pray you, be not you more weary of reading, then I of writing.

A fit thing for a learner not to be weary of reading.

Schol. If I ſhould do ſo, I were much to be blamed; for the pains of ſtudy and writing is greatly to be eſteemed, and to be moſt thankfully accepted.

Gun. Then take this courſe; After you have ordered your Peeces upon your ſeverall Mounts or Plat-formes, under your charge, your Peeces being placed, your ſhot fitted for every ſeverall Peece, your powder well dryed and proved; then let your Plat-formes be all named, with their ſeverall names, as thus, Barris-Mount, Summerſet-Mount, Zouches-Mount, Square-Plat-form, &c. Then in the next place, conſider the Peeces that are placed upon every of theſe Mounts; whether they be Falcon, Saker, Demi-Culvering, or whole Culvering or any other; then for diſtinction, number or mark all thoſe Peeces with marks or numbers upon the knob of the mettal at the end or breech of the Peece; as thus, Falcon number 1-2 or 3, Saker number 1-2-3, Demi-Culvering number 1-2-3, and ſo of the reſt; the Falcons by themſelves, the Sakers and the reſt by themſelves; and whether they be Iron or Braſſe.

Note this.

To name your Plat-formes or Mounts.

To marke or number your Peeces.

Then conſider, the height of the bore or Caliber of the ſeverall Peeces, the height of the ſhot, the weight of the ſhot, the weight of the powder, the length of the Ladle, or the Cartridge to hold ſo much Powder, the length of the diſpart, the fortification in the Chamber, the length of the Peece; and laſtly the weight of the Peece; there is good reaſon for all theſe things, as you ſhall ſee more at large hereafter.

Mark this well howto make a Table of *Randons*.

Now you are to compoſe all theſe things into a Table, ſet theſe things down under the name of the mount, and the particular name of every Peece; then you may proceed further and ſet down the Ranges of all your ſeverall Peeces, under the title of each Peece, as you ſhall ſee hereafter, with the allowance in degrees, and the inches of the Sight-rule to anſwer to every degree of the Quadrant, and thus you may have Tables to anſwer to every Mount, and the nature of every ſeverall Peece upon that Mount, with the diſtance that each Peece will carry levell, and the increaſe of that diſtance upon the Mount of one to ten degrees, which Table once thus finiſhed, will remain alwayes to help your memory, and to reſolve any queſtion that may ariſe touching the Range of every ſeverall ſhot; & this is a thing well worth the pains and labour that you are at, & may do you much pleaſure many yeeres after; therefore, I pray you

Theſe Tables once wel made are made for ever.

you doe not neglect this courſe by any meanes.

Schol. You have propounded a good courſe, but there be divers of the ſame Peeces upon the ſeverall Mounts, and therefore if you would give a Table of two Peeces of every kind, from a Falcon to a Culvering; I think it would be ſufficient for a yong practitioner and by that he may make a Table for himſelf, for all his other Peeces upon their ſeverall Mounts.

Gun. I will follow your adviſe, and will propound 3 Peeces of every ſort. *viz.* 3 Falcons, 3 Sakers, 3 Demi-Culverings, and 3 whole Culverings, whereof every one doe differ, both in weight, length and fortification; which may be a ground for you to make any other Tables by, which table I wiſh you to mark well, for I will propound divers examples upon ſundry Mounts, both in the Caſtle and the Fort adjoyning. But firſt, I will give you a note of my generall ſuppoſition, how farre every peece will carry, beginning at the Falcon, to the Cannon. *viz.* How many ſcore levell (or as the Gunners call it point blanck) and what in ſcores upon a degree as followeth.

An example of two ſeverall Peeces of each kind.

A Falcon will carry levell 16 *ſcore, and upon the Mount of a degree* 8 *ſcore.*
A Saker will carry levell 18 *ſcore, and upon a degree* 9 *ſcore.*
A Demi-Culvering 20 *ſcore, and upon a degree* 10 *ſcore.*
A whole Culvering 22 *ſcore, and upon a degree* 11 *ſcore.*
A Demi-Cannon 19 *ſcore, and upon a deg.* 9 ½ *ſcore.*
A whole Cannon 17 *ſcore, and upon a deg.* 8 ½ *ſcore.*

How farre every Peece will carry levell, and what upon a degree.

Here you ſee my ſuppoſition concerning the diſtance that a peece will carry levell, and upon the mount of a degree, and becauſe it is a concluſion of mine own invention, and not taken out of other mens books; I will endeavour to prove the truth of the ſame as briefly and truly as I can referring my ſelf to others more learned and practiſed in the Mathematiks then my ſelf, wiſhing ſome learned Mathematician to take ſome pains to find the Arch or way of a ſhot, being in my judgement hard to find, but of great uſe when it is found, in the mean time accept of this.

The Table of RANDONS.

	Falcon Brasse 1	*Falcon* Brasse 2	*Falcon* Iron. 3	*Sacar* Brass 1	*Sacar* Iron. 2	*Demi Culv.* Iron. 1	*Demi Culv.* Iron. 2	*Whol Culv.* Iron. 1	*Whol Culv.* Brass 2
The Height of the Bore.	2 - 1/4	2 - 1/8	2 - 3/4	3 - 1/8	3 - 1/8	4 - 5/8	4 - 1/8	5 - 1/4	4 - 3/4
The Height of the Shot	2 - 5/8	2 - 7/8	2 - 1/8	3 - 1/4	3 - 1/4	4 - 3/4	4	5	4 - 1/8
The weight of the Shot	2.l.	2.l.	2.l.	5.l.	4.l. 12 oũ	10.l.	8.l. 11 oũ	17.l. 5 oun	16
The weight of the Powder.	2.l.	2.l.	2.l. 1/2	4.l.	4.l.	7.l.	7.l.	9.l.	8.l.
The length of the Cartridge.	7 inch	7 inch	8 inch	10 in.	10 in	17 in	17 in	19 in	18
The length of the Dispart.	2 - 1/4 inches	2 inch	1 - 1/4	3 - 1/4	3 - 1/4	3 - 1/4	3 - 1/4	3 - 1/4	2 - 1/4
Fortified in the Chamber.	2 - 3/4 inches	2 inch	3 inch	3 - 1/8	5 - 1/4	5 - 1/4	6 inc.	6 - 1/4	5 - 1/4
The length of the Peece.	6 foot 1 inch	6 foot 6 inch	6 foot 6 inch	9 fo.	9 fo. 9 in.	10 fo 2 inc.	10 fo. 8 inc.	10 fo. 9 inc.	16 fo
The weight of the Peece.	700	800	1100	1600	2700	3500	4000	4600	4200

The levell of the Peeces in Scores.	16 Score	16 Score	16 Score	18 Score	18 Score	20 Score	20 Score	23 Score	23 Score
At 1 degree of the Quadrant.	24	24	24	28	28	30	30	34	34
At 2 Degr. of the Quadrant.	32	32	32	37	37	40	40	46	46
At 3 Degr. of the Quadrant.	40	40	40	45	46	50	50	57	57
At 4 Degr. of the Quadrant.	48	48	48	55	55	60	60	70	70
At 5 Degr. of the Quadrant.	56	56	56	64	64	70	70	81	80
At 6 Degr. of the Quadrant.	64	64	64	73	73	80	80	93	93
At 7 Degr. of the Quadrant.	72	72	72	82	82	90	90	104	104
At 8 Degr. of the Quadrant.	81	81	81	91	91	100	100	115	115
At 9 Degr. of the Quadrant.	88	88	88	100	100	110	110	126	126
At 10 Deg. of the Quadrant.	96	96	96	109	109	120	120	137	137

For

A good direction to make your Tables.

For the better underſtanding of this, know that I would have you make your Tables after this manner, of all your mounts and Plat-formes under your charge, after the order that you ſee here ſet down, how many Falcons, Sakers, Demi-Culverings, or whole-Culverings, you have upon your Barris-mount, Zouches-mount, or the Square-Plat-form, and the number, names and nature of the Peeces. *viz.* The height of the bore, the height of the ſhot, weight of the ſhot, weight of the Powder; and ſo as you ſee in the Table.

To anſwere your Commander.

Now ſuppoſe your Generall call you ſodainly and ask what Ordnance are upon Barris, you may make anſwer, ſuch and ſuch Demi-Culvering, Saker, ſtrong or feeble, cracked or the like.

And theſe and many more may be known, and muſt ſuddainly and readily be anſwered, or elſe your Commander may ſay you are an idle Gunner.

The Quadrant a ſpeciall Inſtrument.

But for the degrees of the Quadrant, is chiefly for your own reputation and memory, to know how to make a perfect ſhot at all diſtances, being a great credit and honour to a diligent Gunner.

As for example, ſuppoſe you are to ſhoot three Peeces to a mark, being a buſh within view of the Plat-forme, called Barris-mount, which mark is diſtant from your mount, being 46 ſcore, the peeces a Falcon, a Saker, and a Demi-Culvering, now note that the mount is higher then the mark 2 deg. and a half.

An example at Barris-Mount.

The 6 of *March* 1616, I loded the Braſſe Saker upon Barris-Mount, Saker number 1, and gave her no advantage, but levell by the Quadrant, and ſhot ſhort about 10 yards, then I ſhot again and gave her ½ a deg. above levell, and that was gone 6 yards that is 46 ſcore, ſo the Peece had 3 deg. the Mount being 2 ½ deg. and ½ advantage makes 3 deg. and you may ſee in the Table 3 deg. to range juſt 46 ſcore, and by the Sight-rule 5 inches ½, your Falcon 3 deg. ½, your Demi-Culvering 2 deg. ½, this you may uſe according to your own judgement and diſcretion, but a good Arts-man may proportion theſe things by the uſe of this Table, and the rules of Arethmatick, to a juſt proportion.

The experimentall proof of theſe ranges.

The point that I do aym at, is no other thing but this, to prove the thing to be true concerning the ranges of the Peeces before ſpecifyed, which I will endeavour to prove by mine own experience, as I have practiſed at divers times upon the mounts, and other ſeverall places, whereof I have had experience.

Sebal

Sebol. I begin to ſee the excellent uſe of theſe Tables, if theſe things be true which you ſay, you haue proued by your long experience; but J perceiue that you practiſed not theſe Tables at the firſt, but having written down your ſhot that you had made in former times (a thing that is of great uſe for a man that will profit in this Art) by which meanes, you find by theſe Tables what allowance your Peeces had, and ſo upon this you ground your concluſions, which as I think cannot be much uncertain; yet alway ſome ſmall error may and will happen, as in the loading the Peece, or the temper of the ſame; or in failing or miſtaking in the laying it to the mark, in the ſtrength or the weakneſſe of the Powder, and divers other things, which may make a difference of 5 or 10 yards, and eſpecially at a long diſtance, where the wind and wether ought to be regarded, yet all theſe things makes not the rule falſe or untrue; therefore I ſee a good Gunner ought to uſe great care and diligence in theſe things, and take good heed that he ſhames not himſelf.

He that will profit in this Art, muſt write all his ſhot.

Failing in the Peeces makes not the rule falſe.

But before you proceed any further, I pray let me prove by an example, whether I do underſtand your meaning by this Table, that I may hereafter make the like for my ſelf, when I ſhall ſee occaſion.

Suppoſe that I have a Falcon, Saker, and a Demi-Culvering upon a Mount or Plat-forme, and theſe are to be ſhot to a mark, the diſtance whereof, I have formerly taken, and found it to be 50 ſcore. I begin with the Falcon, and look in the Table, under the title of Falcon number 1. for 50, which is 50 ſcore, and I find now there, that a Falcon will carry 48 ſcore at 4 degrees, and I ſee under 48, 5 inches $\frac{1}{11}$, which ſheweth that 5 inches, $\frac{1}{11}$ of the Falcon, number 1, being 6 foot long, and the diſpart 2 $\frac{1}{2}$, will require 4 deg. by the *Quadrant*, but that will not reach the mark; therefore according to my judgement, I adde $\frac{1}{11}$ more, and that is 5 inches, $\frac{2}{11}$, which I ſuppoſe will carry it, then I come to the Saker, being numbered and diſparted as J ſee in the Table; and under the title of Saker number 1, I look for 50 ſcore, but I find but 46 anſwering to 3 degrees, and to that number do anſwer 5 inches, $\frac{8}{11}$, but it is too litle by 80 yards, and therefore I will allow 5 $\frac{10}{11}$ with the diſpart, which muſt be alwayes conſidered, then I come to the Demi-Culvering, and under the title number 1, I look the diſtance of 50 and that I find, and anſwerable to that I find 3 degrees, and in inches,

The Practice by this Table.

ches $5\frac{1}{2}$, the length that a Demi-Culvering muſt have to carry ſcore with allowing the diſpart, which muſt be alwayes carefu regarded.

So by meanes of this Table, I may well ſee the way, the diſta known to lay any Peece readily and regularly to a mark, wh courſe, as yet I never ſee practiced, or ſet forth in any mans w ting; and now I pray you proceed to the practice in other Pl formes, and I will indeavour to reſolve all your other queſtion this Rule, and I ſee manifeſtly by this, that you propound tha Falcon will carry 16 ſcore levell, and upon a degree 8 ſcore, a ker 18 ſcore, and upon a degree 9 ſcore, and a Demi-Culve 20 ſcore levell, and upon a degree 10 ſcore, which is the thing propounded; But I ſhall hardly give credit to this, except I be ther confirmed by divers examples, which you have proved by practice and experience.

The diſtance known to lay any Peece to the mark by help of this Table.

Gun. Becauſe you are ſo hard of belief in this thing, whe I do not much blame you, that you are ſo hard to beleeve this; ing a matter of ſuch conſequence, I will ſet your wits a work, I ſee you underſtand this Table, and propound my experime and leave you to find out the reaſons.

The firſt of *July* 1611, I made a ſhot in a Braſſe Saker, numb 1, to a tree ſtanding in *Barton*-hedge, being diſtant 64 ſcore, Peece had 6 inches $\frac{1}{4}$ upon her mettal, but with the diſpart be 3 inches $\frac{1}{2}$ makes $9\frac{1}{4}$, this was ſhort 10 yards; I demand what grees of the *Quadrant* this Peece had, and what diſtance the ſh did range?

An example *July* the firſt, 1611.

Sebol. Firſt, I look the Saker number 1, in the Table wher find the diſpart to be $3\frac{1}{4}$, makes $9\frac{1}{4}$; then in the Table I look ſcore, and to that in the left margent, I find 5 degrees, and un 64, I ſee $9\frac{1}{4}$, whereby I ſay, that Saker had 5 degrees by the Q drant and 9 inches $\frac{1}{4}$ by the Sight-Rule, and yet was ſhort, but t was no great matter.

The example explained by the Table.

Gun. The 5 of *November* 1611, I made 3 ſhot from Summ ſet Mount, to Breden-ſtone, being diſtant 57 ſcore, the Peeces all 3 upon their mettal without the diſpart. That is to ſay, the F con number 3, the Saker number 1, the Saker number 2, all a inches, and were all gone over the hill, now I demand what d grees theſe Peeces had by the Quadrant, and how much ev ry one was gone.

An example at Summmer-ſet-Mount 1611, *Nov.* 5.

Seb

Schol. Sir here is a queſtion that will make me make uſe of this Table, for you ſay all 3 lay at 8 inches, and the ſhot went over the hill or mark; I will try this thus by the Table. Firſt, in the Table I ſeek the diſpart of each Peece by it ſelf, the Falcons diſpart being 1 ¼, being added to 8 inches makes 9 inches ¼, and that will require 9 ′ ″, and that will be 7 degrees of the Quadrant, and 7 degrees upon that Peece will carry 72 ſcore, which muſt needs be much gone. The Saker number 1, the diſpart is 3 ½, that added to 8 inches, makes 11 inches ½, I ſeeke a 11 ½ in the Table under Saker number 1, and there I ſee 73 ſcore, and in the Colume of degrees on the left hand 6 degrees, ſo this muſt needs be over; then I come to the Saker number 2, and that diſpart is alſo 3 ½ that added to 8 inches, makes alſo 11 ½, that I ſeek in the Colum under Saker num. 2, and there I ſee that that Peece muſt have 12 inches to carry 73 ſcore and that will be 6 degrees, but this Peece had ¼ of an inch, more then the other, and therefore muſt be gone much further.

The example anſwered.

So the Falcon was gone —— 15 ſcore.
The firſt Saker gone —— 16 ſcore,
And the third Peece was more gone —— 20 ſcore.

Whereby I ſee the exceeding great difference in the ranges of Peeces of contrary length, and a different diſpart, being mounted by the Sight-rule, which without this Table could hardly be found without great pains and trouble, and that Commander that had ſeen theſe ſhot, muſt needs blame the Gunner for his unskilfulneſſe; and therefore it ſtandeth every Gunner upon to ſtudy well this Table, and ſo he ſhall the better perform his duty when he is required. But now I pray you proceed to ſome other example, becauſe I may make uſe of this Table, and ſee the truth of the range of the ſhot according to your firſt Propoſition?

Great difference in the ranges of Peeces of a ſeveral length by the Sight-Rule.

Gun. I will propound an example more upon this Mount, which is this, in *Anno* 1612 *Auguſt* the 25 thoſe 2 Sakers and the Falcon to a tree in *Barton*-hedge, being diſtant 64 ſcore, the Falcon at 7 inches, the Saker number 1 at 7 inches, that number 2 at 7 and a half, I demand how theſe Peeces lay by the Quadrant, and whether they were gone or ſhort, and when you have done, I will tell you how theſe ſhot fell.

An other example on Summerſet-Mount 1612 *Auguſt* the 5.

Schol. I will firſt begin the Falcon number 3 the diſpart being 1 ¼ added to 7 inches makes 8 ¼ inches, and that is hardly 6 deg.

of the Quadrant, and therefore ſhort; the Saker number 1, at 7 inches, the diſpart being 3 and a quarter, added to 7 makes 10 and a quarter, and that is 5 deg. by the Quadrant, and ſhould be but 9 and ſix elevenths, which by that reaſon ſhould be the Saker number 2, at 7 and a half, the diſpart being 3 and a quarter added to 7 and a quarter, makes 10 and a half, which I think might be gone as much as half an inch of the Sight-rule doth come too; Now I pray you tell me how all theſe three ſhot fell?

The example reſolved.

Gun. The Falcon a good length, the Saker 1, ſhort 10 yards the Saker num. 2, gone 20 yards. And thus you may ſee the marvellous uncertainty of the ſhooting in great Ordnance at a long diſtance, the variety whereof have ſtumbled many good Arts men; and troubled many good wits to find out the variety of ſhot, both Philoſophers, and Mathematicians; wherefore, I could wiſh that ſome expert Mathematician would undertake to prove this thing by further experience, for altho the Ranges of ſhot in a long diſtance be to no great uſe in ſervice, yet in my firſt beginning of my practice in this Art, I was very carefull and diligent to come as neere the truth as I could poſſible; and I am ſure, I have ſet forth truer Tables, then as yet I did ever ſee; and therefore, I will take a little more paynes to ſet down ſome other examples which I have practiſed in other Mounts or Plat-formes.

A deſire that ſome learned Mathematician would take in hand theſe Ranges.

Schol. Sir, I ſee that at the making of this ſhot you had not made a Table for any of your Mounts or Plat-forms, and therefore many errors may happen, and alſo there may be much variety in the awry boring of the Peeces, in the ſtrength or weakneſſe of the Powder, in the charging or loading the Peece, in ſcattering or ſpilling the Powder in the Peece before it be put up, in the eaſineſſe or ſtreightneſſe of the wad, in the highneſſe or lowneſſe of the ſhot, and eſpecially the giving ayme by the Sight-Rule or Quadrant for even a haires bredth, or a very ſmall matter being miſſed or miſtaken in the laying of a peece, may make a very great difference at the mark, eſpecially in a long diſtance.

Many faylings may happen in the uſe of Peeces.

When I conſider theſe things, I doe not much marvell though many times good Gunners make bad ſhot ſometimes, for I think it is not your meaning by theſe rules or directions that a man ſhall hit the mark every time, and not miſſe; & therefore I will make uſe of theſe rules, and ſee how well I can frame my ſelf to profit by the ſame.

No Gunner ſo perfect, as not to miſſe ſometime.

And

And thus I work. The mark you ſay is diſtant and from the Plat-forme 64 ſcore, and I will ſuppoſe 3 Peeces, which I am commanded to ſhoot to that mark, being a Saker, a Demi-Culvering, and a whole Culvering; the mark and Plat-forme of an equall height (for that muſt as I take it be conſidered as well as the diſtance) the firſt Saker having the diſpart 3 and a quarter, I ſee in the Table, muſt have 5 deg. by the Quadrant, and by the Sight-rule 9 inches and ſix elevenths with the diſpart; but if I abate the diſpart, then nevertheleſſe the Peece muſt have 5 deg. and but 5 inches ½, and thus I lay this Peece, and go to the Demi-Culvering number 1, and under that I ſeeke 64, the diſtance or the neereſt number thereto, which is 60, which is 80 yards too little, and to that 60 I ſee in the left margent 4 deg. and that 4 deg. muſt have 7 inches and one eleventh; but that will be ſhort 80 yards, that is 4 ſcore, and therefore I will allow her 8 inches; and ſo I go to the Culvering number 1, under which I ſeek 64 ſcore, and there I ſee 70 ſcore, which requireth by the Quadrant 4 deg. and upon the Sight-rule 8 inches and 8 eleventh parts, but that wil be gone 6 ſcore yards; therefore I think 3 degrees ½ will reach the mark with that Peece, and that may be 7 inches ½ with the diſpart, and the diſpart of that Peece being as I ſee, in the Table 3 and a quarter, being abated from it reſts 4 inches, and ſo for the Demi-Culvering, abate 3 ¼ from 8 remains 5 inches; and thus theſe 3 Peeces are laid according to the directions you have appointed by this your Table, which if they prove well, you have performed a good work and have given occaſion of further practice, of thoſe Gunners that are diligent and ſtudious in the perfection of this Art, in the well and orderly handling this furious Engine, that groweth in uſe every day more and more; and I wonder that good Gunners ſhould be ſuffered to want, and that there is no more care amongſt great Commanders for the exerciſing men in the knowledge of great Ordnance, and now for memories ſake, I will gather up all thus, a Saker will have 5 deg., and by the Sight-rule 5 inches, a Demi-Culvering, will have 5 inches and 4 deg. ½, and the Culvering 4 deg. and 5 inches upon the Sight-rule, to carry 64 ſcore?

A rule of practice to be alwayes followed.

The diſpart is alwayes to be well conſidered,

Good Gunners ſhould not be ſuffered to want.

Gun. You have well and carefully obſerved and performed this thing, and have well done in obſerving the diſparts of your Peeces, which muſt alwayes be regarded in ſhooting by the Sight-rule;

The degrees of the Quadrant holdeth as well in ſhort Peeces as long but the Sight Rule not ſo.

but indeed the chief ground of ſhooting is by the degrees of the Quadrant, which holdeth as well in long Peeces as in ſhort, but by the Sight-rule not ſo, for by the Sight-rule, the length of the Peece maketh a great difference as you ſhall ſee hereafter in a Table that I will give you, if God do grant me life; therefore as you have begun in this courſe, go forward alwayes obſerving the diſpart of your Peeces, and the height, whether your Peece be higher or lower then your mark; and thus much I deſire you to conſider if you will ſhoot by Rule, as I have here in this place deſcribed and experimentally proved, but if you will be lazie and idle, as I have known divers braggers do, that have made many ſhot, & have ſometimes hit the mark as the blind man hit the Crow, and could give no reaſon for the ſame, then you ſhall not need theſe rules of direction; but ſtill continue a blind Gunner; nevertheleſſe I will ſet down more Examples of my practice, and leave you to priſe them.

A good Gunner ought to avoid bragging.

Schol. I thank you for your care that you have to give me theſe inſtructions, for indeed I have met with many ignorant idle Gunners, that have had places in the Kings forts this 10 or 12 yeeres, that when they have been asked a queſtion touching the Peeces which they continually do ſerve, can ſay little or nothing either of the length, fortification, or diſpart; and yet will brag greatly what good ſhot they have made, and hold themſelves excellent Artſmen, and yet can give no reaſon for that they do; and therefore they hate all diſcipine, and the rules belonging to this Art, But now I pray you go forward with thoſe your experiments, that you have practiſed upon the ſeverall Mounts or Plat-forms of this Caſtle or elſe-where; and you ſhall ſee I will be diligent to obſerve the ſame?

The thankfulneſſe of a Scholler to his teacher.

Gun. The 7th. of *September* 1612, at the going away of my Lady of *Worceſter* from the Caſtle, 1 Falcon and 2 Sakers on Summerſet-mount, to the corner of Winters-field, being diſtant 65 ſcore, the Falcon at 5 ½ inches ſhort, the Saker number 1, at 6 ½ inches very ſhort, the Saker number 2, at 7 ½ a little ſhort, all layd upon their mettal not diſparted, now try your ſkill by this, how farre each of theſe did range?

An example on Summerſet mount left to tryall.

Schol. I reſort to the Table of this Mount, and I find the Falcon to be 5 inches ½ that is 4 deg. and that will range but 48 ſcore

This tryed by the Scholler.

ſo

ſo that the Peece was ſhort 17 ſcore, the Saker number 1, at 6 ½ Range, but 53 ſcore lying at 4 deg. almoſt; the Saker 2, at 7 ½ Range; but 55 ſcore, which is ſhort 10 ſcore; and thus have I brought this to paſſe by the Table, as neere as I can; and I perceive you had not made you any Table for this Mount, or elſe you could never have made ſo foule a ſhot, being you knew the diſtance.

Gun. *October* the 7th this Saker 1 to the △ diſtance 47 ſcore at 5 inches upon her mettal, gone two Rod plumb upon a bearing bank.

September the 30, 1621, 2 Sakers to the corner of Winters field, diſtant 65 ſcore, that number 1 at 7 inches, ſhort 20 yards; that number 2 at 7 ½ ſhort 40 yards, and thus you may ſee what great difference there may happen in ſhooting when you regard not the length of the Peece, nor the diſpart; for in ſhooting by the Sight-rule, the ſhort Peece will out-ſhoot the long, but by the Quadrant the long Peece will out-ſhoot the ſhort a little, alſo in ſhooting by the Quadrant, you muſt obſerve whether your Peece be higher then your mark, or your mark be higher then your Peece; but by the Sight-rule you need not regard it; therefore you ſee what care a good Gunner ought to have, that hath charge of Ordnance, that regards his own credit or reputation in his place.

Great difference in ſhot, when you regard not the length nor the diſpart of the Peece.

A ſhort Peece will out ſhoot a long by the Sight rule.

Another example on this Mount, and ſo I paſſe to the next. *November* the 5, 1622, theſe 2 Sakers to the corner of Bakers-cloſe, being diſtant 73 ſcore, that number 1, at 9 ¾ inches, a good gone ſhot, that number 2 at 10 ¼ inches ſomewhat ſhort, now you ſhall find by the Table, that that Peece which made the ſhorteſt ſhot, was the longeſt Peece; and ſo of the reſt, whereby you may ſee that a Gunner muſt be content to take pains and to obſerve the reaſons and the cauſe of his fayling.

Atryall that the longeſt Peece made the ſhoreſt ſhot.

And now I come to ſome examples upon Zouches-Mount, the 29 of *Auguſt* 1610, Sir *Iohn Digby* Embaſſador for *Spaine*, came to the Caſtle, 1 Falcon, 2 Sakers, to the △ being diſtant 45 ſcore, the Falcon at 4 inches gone a Rod plumb, the Saker number 3 at 5. gone a Rod plumb, the Saker number 4 at 4 ½ gone more then a Rod plumb, for this was the ſhorteſt Saker.

Auguſt 1611 the *Landtgrave* of *Heſſen*, Imbarqued 2 Sakers upon this Mount, to the Triangle △, being diſtant 46 ſcore, the Sa-

ker

ker number 4, at 4 and a quarter gone a Rod plumb, the Saker number 5, at 4 and a half, gone a Rod plumb.

March the 24, 1612. The Kings Coronation, 3 Sakers on this Mount, to the △, being diſtant 46 ſcore, that number 3, at 4 ¼ a little over; that number 4, at 4 ¼ a good ſhot; that number 5 at 4 and a half, gone 4 yards plumb.

1512 *May* the 21 an example to be well conſidered.

May the 21, 1612. I made a ſhot in the Saker number 3, for practice upon this Mount, to the corner of *Bakers*-Cloſe, being diſtant 64 ſcore, the Peece had 6 and a quarter inches, ſhort 12 ſcore, then I loaded her again, and gave her 9 inches, and this was gone to my thinking 4 yards plumb.

July the 19, 1612, Zouches-Mount. My Lord of *Arundell* was at the Caſtle, 3 Sakers to the △, diſtant 46 ſcore, that number 3, at 4 and a quarter a good ſhot; that number 4 at 3 ¾ hit the mark, that number 5, at 4 and a quarter a little gore; now do you prove theſe examples, and you ſhall ſee that a Falcon will carry levell 16 ſcore, and at the Mount of a degree 8 ſcore, and a Saker 18 ſcore levell, and upon a degree 9 ſcore; which is that I propounded at the firſt.

Note this.

Prove theſe examples.

Schol. Theſe are good Experiments, and fit to confirme one, which being diligently examined by the Table, do manifeſtly ſhew your rule of Ranges to be good. But now I pray ſhow me the courſe and way of the Quadrant, for you ſaid the whole ground of ſhooting is derived from it; let me therefore know the manner of ſhooting by it, in as plain and briefan order as you can?

A good reaſon why the Quadrant is but little uſed among Gunners

Gun. Indeed the ground of all ſhooting is by the *Quadrant*; But becauſe it is troubleſome and unfit to be uſed in time of ſervice or in haſte; the Sight-Rule was invented being the readieſt way to make a ſhot in haſt, but this way by the Sight-rule was derived from the Quadrant; and therefore Mr *Bourn* in his book of great Ordnance, hath ſet forth a Table that doth ſhew what inches and parts of an inch doe make a degree of the *Quadrant*, according to the length of the Peece, which Table I will give you hereafter; but this is the manner of ſhooting by the Quadrant, you muſt firſt conſider whether your Peece be higher then your mark, or your mark higher then your Peece, that is how many deg. of the Quadrant the one is higher then the other, or whether your Peece and your mark be levell, and this you may know by your Quadrant thus.

Diſpart

Diſpart your Peece very exactly, and lay your Peece ſo diſparted, I mean the diſpart ſet or faſtened, with wax or clay upon the Peece; then lay the top of the diſpart to the mark, and put a Quadrant into the mouth of the Peece, and you ſhall ſee by the thred whether it be levell or above levell, or under the levell by ſo many degrees as the thred ſheweth, and ſo lay your Peece accordingly.

The way and method of the ſhooting by the Quadrant.

As for example, I am to ſhoot by the Quadrant to a mark diſtant 64 ſcore in a Saker, I find by the Table a Saker will require 5 deg. to carry 64 ſcore, then I diſpart my Peece and lay her to the mark, and I find the thred to fall 2 deg. and a half under levell, whereby, I know my Peece ſtands 2 deg. and a half higher then the mark; and therefore, I give her 2 deg. and a half more, and that ſhall wave it; but if your mark were higher by 2 deg. and a half then your Peece being laid by the Quadrant to the mark, being diſtant 64 ſcore, you muſt not adde that 2 half deg. to 5 deg. and that is ſeven and a pelf deg. and that will be over and more then the other by 2 half deg. and therefore mark well this courſe or elſe you may commit many errors.

Mark this well

Note that when your mark is higher then your Peece, you need not account it.

Schol. I ſee by this, that ſhooting by the *Quadrant* is very troubleſome in quick ſervice; and therefore to be practiced at leyſure times, but yet in no wiſe to be neglected; for I ſee it is indeed the principall ground of all ſhooting as you ſaid before, but I much commend the Sight-rule for the readineſſe thereof, if there be no other difficulty therein, then yet I ſee, nevertheleſſe I would be loath to be to ſeek in the uſe of the Quadrant; and therefore another example or two might do well to cleere my underſtanding.

The Quadrant to be practiſed at leyſure times.

Gun. Your former ſpeech hath put me in mind to tell you the difference between the Quadrant and the Sight-rule, in laying a Peece to a mark; as thus, when you lay a Peece by the Quadrant you need not regard the length or ſhortneſſe of the Peece, for a degree is a deg. in a Peece of three foot long, as in a Peece of 10 foot; but by the Sight-rule not ſo, for every half foot difference in the length of the Peece doth make a quarter of a degree difference or thereabouts, and an error is many times committed, as thus. Say I have ---

The differences between the uſe of the Quadrant and Sight rule.

Two Demi-Culverings ſtanding upon a Plat-form of different lengths, but equall in all other reſpects, theſe are to be ſhot to a mark, and the one Peece is 10 foot and $\frac{1}{2}$, and the other is 9 and a half

Note that in a Peece of 9 foot and a half long that 2 inches doe make a degree.

An example of two Demi Culverings.

half, if you lay theſe Peeces by the Sight-rule to a mark, and give them a like length by the Sight-rule the ſhorter will out-ſhoot the longer; but if you lay them by the Quadrant, the longer may ſomewhat out-ſhoot the ſhorter; for it is generally held by expert men that a long Peece will out-ſhoot a ſhort.

The want of this conſideration hath deceived many Gunners.

Theſe things I think good by the way, to give you notice, for the want of this conſideration, I am perſwaded hath deceived many Gunners, now according to your requeſt, I will propound an example or two which I have experimented, both with the Quadrant and Sight-rule; and how the ſhot fell that were ſo made.

Example of three Sakers on Zouches-Mount.

Auguſt the 5, 1622. Three Sakers upon Zouches Mount, to an Aſh-tree being diſtant 77 ſcore, theſe Peeces being diſparted, were layd to this mark, and by the practice before ſpecified, I find that the mark is lower then the Peece or mount by 3 degrees, for the thred cut 3 deg. under levell; now you know the diſtance to the mark, and the height or ſcituation of the Peece, and the mark; let me ſee you try your skill, and lay theſe Peeces to paſſe according to Art?

The practice of this example

Schol. Having found by my Quadrant, that the Peeces being diſparted do lye higher then the mark by 3 degrees; I look in the Table for 77 ſcore, which number I do not find, but I find 73, and to that anſwers 6 deg. of the Quadrant, but that will be ſhort 60 yards, and therefore I will alow 6 $\frac{1}{2}$ deg. now abating 3 deg. there remaines 3 deg. $\frac{1}{2}$, and as I think, if your rules be true theſe will be good ſhot.

An example of the Quadrant and Sight-rule together.

Gun. Indeed theſe were reaſonable good ſhot, conſidering the long diſtance which may make much variety in the flying of a ſhot; and ſeeing I ſee you underſtand the Quadrant alone, I will propound you an example of the Quadrant and Sight-rule together; which you may try together.

The 3 Peeces to the Pole.

March the 24, 1621. Theſe three Peeces upon this Mount to the Pole or moule Rod in the Sea, being diſtant 70 ſcore, the Peeces will require 6 deg. but that will out-ſhoot 60 yards; I laid the firſt peece at 12 inches deing diſparted, and that requireth 6 deg. the ſecond had 9 $\frac{1}{2}$ and lay 2 deg. $\frac{1}{2}$ above levell, the Peece or Mount is 4 deg. higher, ſee what you can do with this?

Schol. Thus I work, firſt I conſider the height of the Mount above the mark, which is 4 deg. then the diſtance to the mark, being

ing 70 ſcore, you ſay theſe Peeces were all laid by the Quadrant, the two firſt at 2 degrees above levell, and the laſt at 2 ½ degrees; now theſe Peeces being tryed how they lay by the Sight-rule; I find that the 2 firſt lay 12 inches, and the laſt at 12 ½, all being diſparted; now I find by the Table that 12 inches will require 6 deg. but that will carry 73 ſcore; and therefore I ſay if the Peeces had been all of one length, they were all 60 yards gone, I pray now tell me how they did fall (Anſwer) the 2 firſt were gone to my thinking above 25 yards, and the laſt above 60 yards.

Gun. This is well obſerved, wherein you ſee that in ſhooting by the Quadrant you muſt alwayes take heed that you obſerve the heights of your Mount and mark which is higheſt, and ſo lay your Peece.

Alwayes in ſhooting by the Quadrant, to obſerve the height of the Mount.

As thus, ſuppoſe your mark be lower then your Peece 3 deg. or 4. or 5, or whatſoever; take your Peece, be it Saker or Demi-Culvering, or any other, take and diſpart the ſame exactly, and lay the top of the diſpart to the mark, and obſerve what deg. and parts the plummet and thred ſhoweth ſuppoſe the ſame be 3 ½ deg. and you are to allow 4 deg. to reach the mark, being diſtant 55 ſcore, your Peece being a Saker of 9 foot ½ long, now your Peece being diſparted and laid to the mark, being 3 ½ deg. under levell; alwayes from that ſcituation Mount your Peece, as if your diſtance require 4 deg. and the height you ſtand on be 3 deg. and a half then half a deg. above levell will reach the mark, and that with the diſpart in a Peece of 9 foot and a half, will be 8 inches.

Theſe rules to be carefully ſtudyed.

Now ſuppoſe your mark ſtand 3 half deg. higher then the diſpart, and lay your Peece to the mark, being as aforeſaid 55 ſcore, which will require 4 deg. then raiſe your Peece to 4 deg. not at all regarding the height, and you ſhall do well, for that by the Table is likewiſe 8 inches, if you will be carefull to mark & ſtudy theſe rules, to which the uſe of this Table doth direct you and alſo follow theſe my directions; I cannot ſee that any thing that may be propounded can be ſo difficult, nor any queſtion can be made but it may be anſwered, and perfectly reſolved by the right uſe and underſtanding of this Table; and to tell you the truth, there is more to be found out by this courſe to him that will bend his mind to ſtudy this Art; then I my ſelf can yet conceive or underſtand.

Therefore let every one that hath charge of Ordnance, and is put

A speciall admonition for a Mr. Gunner.

in truſt to be Mr. Gunner of a Fort, after his Peeces be placed upon their ſeverall Mounts or Plat-formes, let him name his Mounts, name his Peeces, mark or number his Peeces, meaſure his Peeces, and finally, make a Table according as you ſee here in this example of all his Peeces. which though it be ſomewhat tedious, and great care to be uſed in the doing, yet when it is done, it is for ever, and that man ſhall not repent him of his paines; but will find great eaſe all his time after in whatſoever place he commeth.

Schol. I will from henceforth be carefull to apply my mind to the uſe of theſe Tables, but me thinks I am not yet ſatisfied concerning the difference of the height between the mark and the Peece, for you ſay that when the Peece is higher then the mark by 2, or 3, or 4 degrees; I muſt abate that in the deg. concerning the length or diſtance, but when my Peece is lower then the mark, it is not to be regarded, which makes me muſe; but by the Table I ſee it is all one, for 4 deg. of the Quadrant will carry 55 ſcore, which makes 8 inches; but to go to the right truth of the matter, I think as I did abate when my mark is lower then my Peece, *viz.* I lay the mouth ſo much lower, ſo when my mark is higher then my Peece, I muſt adde at the breech, which is already done to my hand, whether I ſhoot by the Quadrant or Sight-rule, in ſhooting up hill, now if you will goe forward I will not trouble you any further, for I do now partly know your meaning, and the uſe of the Table, which is an excellent thing for practitioners.

A doubt to be well underſtood.

Gun. I will propound an example or two which I have experimented upon other Mounts in this Caſtle, and leave you to examine them at your leyſure.

November the 5, 1621. Three Sakers from Zouch-Mount to the corner of Bakers-Cloſe, diſtant 64 ſcore, the Peece higher then the mark 2 degrees; theſe were all three layd by the Quadrant at 3 deg. above level, which in all makes 5 deg. all very good.

Examples upon Muncks Mount.

June the 11, 1621. I made a ſhot for practice in the Braſſe Saker number 6, to the point of the *Beark*, at the North Peere head, being diſtant 50 ſcore, if the Peece with the diſpart had 6 ½ inches, but this was gone above 20 yards, being over-laden, and at that time cracked, and was never ſerviceable after.

Examples on Muncks Mount

Auguſt

Auguſt the 5, 1620. The Saker number 7, to the Triangle, being diſtant 48 ſcore, the Peece had juſt 6 inches with the diſpart, in this Peece more then 3 deg. a good ſhot.

November the 5, 1620. The two Braſſe Sakers to the corner of Bakers-cloſe, diſtant 70 ſcore, theſe Peeces had each of them 10 inches ½ which makes about 5 deg. ½, theſe were both very good ſhot; the Mount a deg. higher then the mark, which in all makes 6 deg. Note if you had a Table for every Mount, and could take a diſtance you were well.

March the 24, 1622. Upon this Mount the Saker number 7, to *Winkefields*-mark, being diſtant 60 ſcore, this Peece had 8 inches with the diſpart, and that makes about 4 ½ deg. ſhort; but a reaſonable fayre ſhot.

Now I will proceed to the Bulwark Plat-form, where ſtandeth 4 Demi-Culverings and a whole Culvering.

March the 24, 1619. I made a ſhot in the Demi-Culvering number 4, to the South head, the Peece had 8 ½ inches with the diſpart; the mark diſtant 60 ſcore, the Peece at 4 deg. and better a good gone ſhot.

Examples on the Bulwork Plat-forma.

Auguſt the 5, 1620. Foure Demi-Culverings to the Pole or moule Rod, in the Sea, being diſtant 52 ſcore, the Peece number 1, at 6 ½ with the diſpart that makes about 3 deg. ½, a litle gone, the Peece number 2, at 6 ½ inches, diſparted, that makes 3 ½ deg. gone above a ſcore; that number 3, at 6 ½ diſparted, that makes 3 ¼ a fayre over-ſhot; that number 4 at 6 ¾ that is 3 deg. ½, gone a ſcore at almoſt full Sea.

In ſhooting to the Sea obſerve the Tide.

Note that in laying any Peece to the moule or any other mark at Sea, you muſt obſerve the ebbing and flowing of the tide, for there is 18 foot difference between low water and full Sea, therefore if you lay your Peeces at low water, and ſtay till full Sea before you ſhoot, you will be ſhort; and if you lay your Peeces at full Sea, and ſtay till, and ſhoot at low water, you will be gone.

November the 5, 1618. Three Demi-Culverings to the Pole, diſtant 52 ſcore, that number 1 at 7 ½ inches, that makes almoſt 4 deg. diſparted, gone 5 ſcore, that number 2 at 7 ½ which is likewiſe 4 deg. gone beyond the other, that 3 at 8 ½, 4 deg. gone 10 ſcore.

Auguſt the 5, 1622. Theſe three Demi-Culverings to *Winke-*

fields mark, being distant 62 score, the Peece number 1 at 5 $\frac{1}{4}$ inches, and the dispart being 2 $\frac{1}{4}$ makes 8 inches $\frac{1}{4}$, that is 4 deg. $\frac{1}{4}$ a good shot, that number 2 at 8 inches dispart makes 4 deg. somewhat short, that number 3 at 8 $\frac{1}{4}$, that is 4 deg. and better, gone a yard.

All this doth prove this invention good.

And so I end the practice upon this Plat-form, where though you see some bad shot, yet this my invention touching the Range of a shot doth according to my first proposition, a Demi-Culvering 20 score levell, and 10 score upon a deg. for the proofe whereof I have taken the pains to contrive these Tables to ease those that are diligent Practitioners.

Examples upon the Square-Plat-form.

November the 5, 1612, Upon this Plat-form standeth 7 Peeces. *viz.* 6 Demi-Culverings, and one whole Culvering, these 6 Demi-Culverings to *Winkefields* mark, being distant 72 score; the Peece number 5, at 9 inches disparted, that is 5 deg. almost short 40 yards; that number 6, at 9 inches short, as the other; that number 7 at 10 inches, that is 5 deg. and better, this short 20 yards, that num. 8 at 10 inch. short a little, that number 9 at 9 inches, that is 5 deg and better short, that number 10 at 8 $\frac{1}{4}$ inches that is hardly 5 deg. short, also these Peeces were at the first laid not disparted all at 6 inch $\frac{1}{2}$ & when they had all the disparts set up, they lay as you see here, where you may see the difference between disparting and not disparting, now if these Peeces had been all laid at 5 deg. and a half, would have been good shot,

Examples upon the Square Plat-form.

November the 5, 1613. Two Demi-Culverings to *Winkefields* mark, being 72 score, that number 7, at 7 inches, and the dispart being 3 and a half, makes 10 and a half inches, that [illegible] the Table 5 deg. a good shot; [illegible] number 8 at 7 and a half, and the dispart 3 and [illegible] quarter, makes [illegible] three quarters, being 5 deg and better, a very faire sho[illegible]

May the 14, 16[illegible] [illegible]rd *Hayes* Imbarqued for *France*, 2 Demi-Culvering[illegible] 1619. My [illegible] being distant from this Plat-forme 53 score, the Peece[illegible] to the Pe[illegible], at 7 and a half disparted [illegible] that is 3 and a half deg. go[illegible] number 6 at 7 and a half, that is 3 and a quarter deg. gone [illegible] the other, above 16 yards.

April the 18, 1615. Two Demi-Culverings to *Winkefields* mark, distant 72 score, that number 8, at 1[illegible] half inches, being

ing 5 deg. and better, a very good ſhot at a yard, that number 9 at 10 and a half diſparted, being as afore at 5 deg. and more, a very good ſhot; alſo here you may note the difference that doth fall out in ſhooting, at ſome one time more then at another, for you ſee before that the ſame allowance was ſhort, which now proved good ſhot.

March the 24, 1621. Theſe 6 Peeces to the Pole at the diſtance 53 ſcore, that number 7, at 7 and three quarters diſparted, makes 3 and a half deg. that gone a ſcore, that number 10, at 6 and a half inches, being 3 deg. and a quarter a little gone and wide, that number 5 at 7 inches, being 3 and a quarter a good gone ſhot, that number 6, at 6 and three quarters, which upon this Peece makes 3 deg. and more about 2 yards gone, that number 8 at 7 and a half, that is 3 ¼ deg. gone 10 yards, that number 9 at 6 inches and three quarters, that is 3 and a quarter deg. gone 6 yards.

July the 23, 1621. My Lord *Hayes* went Embaſſadour into *France*, 6 Demi-Culverings to the Kings ſhip, lying at Anker in the road; I took the diſtance to the Ship, being 146 ſcore, theſe laid a ſtern, the Ship by the Quadrant at 10 deg. beſides the advantage of the Cliff they were ſhort of the Ship above 80 yards, the diſtance a mile and a half and more.

Auguſt the 5, 1621. Foure Demi-Culverings to the moule Rod or Pole, diſtant 53 ſcore, theſe Peeces were all laid by the Quadrant put into the mouth, being all diſparted, and the top of the diſpart laid to the bottom of the moule-rod at high-water, and I find that then the mark lyeth under or lower then the Plat-form, or the Peeces 4 deg. and a half, now the mark being diſtant 53 ſcore and ſo they lay with the diſpart; which being ſhot, made all very good ſhot.

Note that theſe Peeces lay under levell almoſt 2 deg. at high-water; but if I had ſtayed till low water, before they had been ſhot, they would have been much gone, for the water riſeth there in height 18 foot plumb. A good note.

The ſame day two Demi-Culverings to the △, being diſtant from this Mount 56 ſcore at 7 inches and a half, that is 3 deg. and a half, the one did hit the mark, the other at the ſame advantage a little ſhort.

By this you may know, that as yet the rule doth hold true, that a Demi-

Demi-Culvering, will carry 20 ſcore levell, and 10 ſcore upon a deg. but there may be occaſions that may make much fayling as I have formerly ſaid, neither yet could I ever find out the reaſon of the variety that happeneth in the Range of a bullet; but this I have tryed, that yet I never could ſhoot into the ſame hole, with all the cunning that I have, which once I tryed upon this Plat-form.

I tryed to ſhoot into the ſame hole.

I layed one day a Demi-Culvering at this Plat-form, being 53 ſcore to the △ at 5 inches without the diſpart, and made a good ſhot to that mark, then I deſired to try if I could ſhoot with the ſame Peece in that hole which the ſhot made, and to that end I loaded the ſame Peece again, with the ſame Powder, wad and ſhot, as I did before; and laid it as preciſely as I could for my life, as ſhe lay before to the hole that the firſt ſhot made, and that ſhot fell ſhort of the other by 4 yards, whereby I might ſee the great uncertainty of ſhooting in ſuch a long diſtance, and therefore let not the beſt Artiſt that is, euer think to hit a mark alway at ſuch a diſtance, but if the mark had been neerer or within the levell range of the Peece againſt a But or bearing bank, I hold it poſſible to ſhoot within a yard Compaſſe if he take any care to diſpart his Peece truly, and be carefull to lay her well, if the mark as I ſaid, be within 12, 18 or 20 ſcore. And thus much for the Practice upon this Plat-form, where ſtandeth 6 Demi-Culverings and a whole Culvering.

The beſt Artiſt that is, cannot alwayes hit the mark.

The Baſiliſco Plat-forme.

March the 24, 1622. The Baſiliſco to the △, being diſtant 60 ſcore, the Peece with the diſpart had 10 inches and three quarters, and that on this Peece being 23 foot long, doe make about 2 deg. & a quarter, this was gone above 10 yards plumb againſt a bearing bank, which if it had been plain levell ground, would have been gone above 6 ſcore, now by this concluſion I conjecture that this Peece being loaden with 18 pound of Powder, and 10 pound of ſhot, will carry 30 ſcore levell, and 15 ſcore upon a deg. which is a great matter.

The practic at the Baſilisco Plat-form.

Auguſt the 15, 1613. Sir *Robert Bret* Lieutenant of the Caſtle, being deſirous to ſee how this Peece would carry her ſhot, cauſed me to load this Peece, which I did with 18 pound of powder and laid her to the △, at 60 ſcore diſtance, the Peece had 9 and a quarter with the diſpart, and this is 2 deg. this did juſt hit the mark to my

my great credit and reputation; and here note, that this Peece by reaſon of her length will ſhoot very right, and do not reverſe much above a foot by reaſon of her great weight, and therefore ſhootes very ſure.

Note that a Peece that doth not reverſe wil ſhoot very ſure

Auguſt the 5, 1617. The Baſiliſco to the △, being diſtant 60 ſcore the Peece diſparted had 10 inches, which makes above 2 deg. a fayre gone ſhot, and by this I gather that this Peece will carry 30 ſcore levell, and 15 ſcore upon a degree loaden with 18 pound of powder, which is three times as much as doth charge a Demi-Culvering.

Auguſt the 5, 1622. The Baſiliſco to the Cony-borow at *Maxton*, being diſtant about 120 ſcore, which is neere a mile and a half, the Peece diſparted, had 23 inches, and that upon this Peece is but 4 deg. and three quarters, that will carry but a 100 ſcore, ſo this was ſhort above 20 ſcore, the Culvering there to that mark, had 17 inches and a quarter diſparted, and that makes juſt 8 deg; but this was 6 ſcore ſhott of that mark.

November the 5, 1617. The Culvering to *Winkefields* mark, being diſtant 73 ſcore, this with the diſpart had 9 inches and a quarter, that is 4 deg. a good ſhot a little gone.

May the 14, 1618. My Lord *Hayes* being at the Caſtle was deſirous to ſee a ſhot in the whole Culvering, to the point of the *Beach* towards the South Peere-head, being diſtant 70 ſcore, the Peece had 8 inches and a quarter diſparted, that by the Table makes 4 deg. gone about 10 yards, whereby you may ſee that a Culvering will carry 22 ſcore levell, and a 11 ſcore and a half, upon a deg. which proportion I have alway obſerved.

1625. At the Buriall of *Thomas Raymond* one of our Gunners; The whole Culvering to the △, being diſtant 61 ſcore, at 7 and a half diſparted, that is about 5 deg. and three quarters, a good ſhot hit the mark.

Now followeth ſome Practice upon the Saker Plat-form.

March the 24, 1619. The two Sakers to the Pole or moule-rod in the Sea, diſtant 57 ſcore, the Peece being diſparted had 8 inches, that makes 4 deg. and a half a good gone ſhot.

Auguſt the 5, 1620. The Falcon and the two Sakers to the Pole, being diſtant 57 ſcore, the Falcon at 7 and a quarter diſparted

The practice upon the Saker Plat-forme

ed, that is 5 deg. ſhort 10 yards, the Sakers at 8 inches diſparted, that is 4 deg and a half a little gone.

Auguſt the 5, 1622. The Falcon and two Sakers to *Winkefields* mark, diſtant 75 ſcore at 9 $\frac{1}{2}$ diſparted, that is 6 deg ſhort, the Sakers at 10 and a quarter, makes hardly 6 deg. ſhort alſo.

Auguſt the 5, 1624. The Falcon and two Sakers to the Tryangle diſtant 64 ſcore, the Falcon at 9 and a quarter makes 6 deg. a good ſhot, the Sakers at 9 and a half, makes 5 deg. both good ſhot.

Hepſlyes Mount.

The practice upon *Hepſlyes* Mount.

Vpon which Mount, fel out a great miſchance in *Anno* 1645, *March* the 17, by breaking a very ſound whole Culvering, & killed the Gunner.

Becauſe I have I have had but little practice upon this Mount, I can ſay but little by experience; yet as though I were in a ſtrange place, I will prove to lay theſe Peeces to the Pole, being diſtant 58 ſcore, the Culvering number 1, muſt have 6, $\frac{7}{8}$ inches, that is 3 deg. and better, the Culvering number 2, muſt alſo have 6 inches, $\frac{7}{8}$, being alſo above 3 deg. the Demi-Culvering muſt have 7 $\frac{1}{8}$. that is 3 deg. and three quarters, but to ſhoot theſe Peeces upon the mettal, without the diſpart they will all lye at 3 inches $\frac{1}{2}$.

I could here produce many other examples in this kind, but I think theſe ſufficient; for thoſe that will be diligent Practitioners for the knowledge of theſe Tables, and to prove the truth of the Ranges of the ſhot; which though there may be ſome fayling in ſome things, as you may ſee bad ſhot in divers examples, yet in the generall they hold true; for I confeſſe I had ſhot many a yeare before I found out theſe Tables, and made many bad ſhot for want of theſe Tables.

But yet I will endeavour to prove the levell, and the increaſe of the range of the ſhot, at the mount of a deg. by a more true and ſpeciall practice, as hereafter followeth.

A further proof of the truth of theſe Ranges.

Now for further proofe of this my skill, and to verify the ſame concerning the Range of a ſhot; I will ſet down an example of a Saker which I tryed in *Dover* Caſtle at the Saker Plat-form, in *anno* 1611 the 2 of *July*

I then laid a Saker at that Plat-form, ſtanding 94 yards high, & ſhot along upon the Beach, being true water levell from the foot of the Plat-forme or Cleff whereon the Peece ſtood; I laid this Peece levell by a true Quadrant, being loden with 4 pound of fine

powder

powder & then ſhot her off along upon the Beach thē I went down and measured from the foot of the Cleff where the Peece ſtands to the fall of the ſhot and found it to be 242 rods, that is 1331 yards, that is 66 ſcore 11 yards, and there I left a viſible mark, that I might ſee it, and went up and loaded the Peece in all reſpects as at firſt, then I diſparted the Peece very carefully, and laid her to the mark which I had left. *viz.* The place where the ſhot fell being 66 ſcore, and then by the Quadrant I found her to lie 5 deg. and a half under levell, then I made the ſecond ſhot towards the ſaid mark, and when I meaſured it, I found the ſame ſhort of the other for that ſhot went but 368 yards, and that is but 18 ſcore and 8 yards; whereupon I conclude that that muſt needs be the levell of the Peece, and then there will be 48 ſcore to be divided into 5 parts, that will be 9 ſcore and better upon the mount of a deg. then I made an other ſhot, and layed the Peece at 1 deg above levell, and that ſhot did Range beyond the other 186 yards, that is 9 ſcore and 6 yards, for the Mount of one deg. above levell.

By an example of a Saker at the Saker Platform.

Note well this true tryall.

Now conſider the whole diſtance that the ſhot did Range, which the firſt ſhot was 1331 yards, and at the ſecond 186 yards further, makes 1417 yards, that is 70 ſcore 17 yards, which by the Table will require 6 deg. or thereabouts which you may find this Peece had in all; whereupon I conclude moſt certainly, that a Saker will carry levell 18 ſcore, and upon the Mount of a deg. 9 ſcore which is that which I have propounded in all my former Examples.

Theſe diſtances were carefully meaſured with a Chayn of foure Rods long.

Note that I have not been curiouſly exact in this example; but exact enough to declare the truth of this courſe; for it is not poſſible to find out the true and certain courſe of the flying and Range of a ſhot.

But yet for the better confirmation of this which hath been ſaid concerning the Range of a Saker ſhot; I will ſet down here a perfect tryall, which I proved in an Iron Saker upon the Sands at *Deal* Caſtle as followeth.

The worthy and ingenious Gentleman Mr *William Bing*, Captain of his Majſties Caſtle at *Deale*, after great coſt and pains in the ſtudy of this Art; was pleaſed to ſend for me to come over to him to *Deale* Caſtle in *Anno* 1636 *Auguſt* the 30, at which time he had cauſed all his company of Gunners and Souldiers to attend, and had drawn out a Saker of Iron of 2500 weight; upon the

A tryall of a Saker upon the Sands at *Deale* Caſtle.

Sands, being a perfect levell for the ſpace o two mile.

The Peece being placed upon a ſlight Plat-form of Deale-bords we loaded the ſame with Cartridges holding juſt 4 pound of powder, and weighed alſo all the ſhot, this Peece being carefully loded, was layd by the Quadrant very levell, and being diſcharged the firſt ſhot did Range 19 ſcore.

The 2d. ſhot at 1 deg. —— 12 ſcore further, that is 31 ſcore; the 3d. ſhot at 2 deg. 43 ſcore; the 4th ſhot at 3 deg. 45 ſcore; the 5th. ſhot at 4 deg 67 ſcore; the 6th. ſhot at 5 deg. 79 ſcore; the 7th. ſhot at 6 deg. 90 ſcore; the 8th. ſhot at 7 deg. 111; the 9th ſhot at 8 deg. not ſeen, the 10th alſo not ſeen.

By this practice may be ſeen that there is much uncertainty in the flying of a ſhot, and alſo great difference may happen in loding, wadding, and in laying the Peece by the Quadrant; neither doe I think that the deg. from 1, to 10, do increaſe proportionally; but I leave this to be diſcuſſed by ſome learned Mathematician, that loves curioſity, and wiſh all diligent Gunners to inſiſt upon this courſe; for I doe verily beleeve, that a better, truer, or readier way was ever yet ſet forth.

A great commendation of a good Comman. der.

And this worthy Captain to be much eſteemed for his coſt, paynes, and care, to train up and exerciſe his Gunners in this Art; being of great and invaluable conſequence, eſpecially in theſe moſt dangerous and troubleſome times.

Let all Captaines and Commanders of Forts, and Caſtles therefore, be exhorted to ſee to the ſufficiency of ſuch Gunners as take the Kings pay, under their charges, and ſee that they be skilfull and knowing men, and lovers of their Art and Profeſſion, or elſe let them be diſplaced.

Now although I could produce many more Examples in this kind, yet I hold this to be ſufficient for the underſtanding of this my work, wherein I have not onely taken great paines for my ſelf; but alſo endeavoured the good of others that delight in this excellent Art: for when I was firſt admitted a Gunner, I thought it a ſhame to take the Kings pay for a Gunner and doe no other ſervice then to watch and ward, and to load a Peece and ſhoot her off; which even every foole may doe, therefore calling to mind my duty to God and my Soveraigne, I endeavoured with my whole heart to be skilfull in this Art, and for my better proceeding in this

knowledge

knowledge in this, after I had my Place, and had enjoyed the ſame about a yeere or more, and did ſee the uncertain courſes that the old Gunners that were before me did take, wherein I ſaw no rule, or any method obſerved by them, that I might ſafely follow, and conſidering that I had ſome skill in Mathematicall concluſions, and having divers kinds of Inſtruments for taking diſtances, I thought with my ſelf to bring this Art to a certaine method, and to that end I made me a Book, wherein I did write down all my ſhot that I had occaſion to make from time to time, noting the Peeces, the Plat-form, the mark, the diſtance, the advantage of the Peece, and laſtly, the fall of the ſhot; whether it were wide, ſhort, or gone; which courſe when I had obſerved the ſpace of a yeere or two; and looking upon my note-book, I did find it poſſible to give a neere eſtimate of the levell Range of a ſhot, and the increaſe of the ſame at every deg. from one to ten deg. and becauſe this my obſervation which I have diligently practiſed almoſt 40 yeeres, may not be forgotten (although I have had little cauſe) yet for the good of my Country, and the duty and allegiance I owe to my King, and his Parliament; I have undertaken now in this 81 yeere of my Age, to publiſh this my experimented payns, whereat if any man ſhall Carp or find fault, let me deſire him to be ſilent till he can amend this my Work, and then I am ſure I ſhall not here from him in this generation.

The Authors proceeding in this Art.

My duty and Allegiance to my King and his Parliament.

And thus I have briefly ſet down the courſe and cauſe of this my book, exhorting thoſe that will be Gunners to follow the ſame.

A brief manner and way to take a Diſtance to any marke within the ſhot or Range of a Peece.

Scholler.

SIR, I have diligently conſidered your diſcourſe, and your reaſons concerning the Range of all manner of ſhot; alſo your paynes in contriving this work, with your exhortation to all carefull and diligent Gunners, to follow and obſerve ſuch wayes and courſes as you have begun and preſcribed, for it is moſt certain that the idle and unskilfull Gunner in a Fort or Caſtle, is little better to be accounted of then a Traytor, for when his Commander or Captain hath moſt need, he is ſure to be deceived; whereas a diligent

The conſideration of a good and diligent Scholler

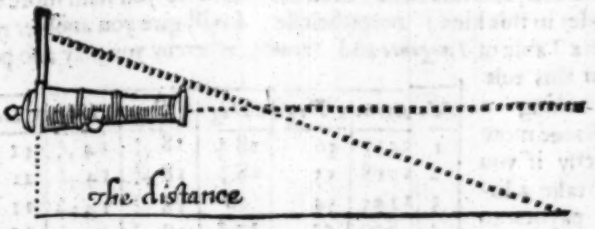
gent and skilfull man, is a joy and a comfort both to Captain and company; the consideration of these things hath caused me with great desire to intreat you to give me some plain rules of direction to take a distance to a mark without the which knowledge a Gunner may well be said to be lame, and reputed a blind Gunner, because he knoweth not what he doth, and I would be loath to be accounted such a man.

Gu. I like well your resolution, and would be glad to give you full satisfaction; but it is not every mans case to know or to have the skill to use such Mathematicall instruments as are requisit for such a businesse, such as are the plain Table, the Theodelite, the Circumfererenter, the Crosse-Staffe, and many other instruments, every of which will require a long discourse, and require great paines to attain the knowledge of the same, all which Instruments I have used at leysure times; but because these do more belong to the Engineere then the Gunner, I will let them passe, and will set down such plain directions as may be performed by the Gunners Quadrant and Sight-rule, and a payre of Compasses; but I would not have you or any man to think that this is performed so precisely, but some difference may fall out, of a 4 or 5 yards or more, in a long distance, and moreover this I say, if you take your distance never so true, yet you shall never order your Peece so in a long distance to shoot in at the same hole; but you may be very neere, and may serve your turn to help you to make a fayr shot to a mark, which you cannot else doe, except you know, or at least give a neere estimate of the distance; but I will be brief in this matter, referring you to other Mathematicall works, of such men as have formerly written of such things, as Mr. *Digs* his *Tectonicon*, and his *Pantometria*, and to Mr. *Bourne*, to Mr. *Smith*, to Mr. *Lucar* upon *Tartaglia*, and for the most part all that have written of measuring of Land have written of the way or manner to take a distance; but because we treat of Gunners Art, and the way or meanes to make a good shot, I will assay to do it with the Peece it self, and the help of the Quadrant.

Therefore if your Mount or Plat-form be upon a hill or a Tower, or Cleff, or Rock towards Sea or Land; take your Peece and Traverse her to the mark or place of which you desire to know the distance, and dispart exactly, your Peece laying just right

Not every mans case to know the use of Instruments and to take a distance.

You cannot make a fayre shot except you know the distance.



right with the ſame, then lay her perfectly levell, by meanes or help of your Quadrant, then take your Sight-rule and ſet it upon the Baſe-ring, as though you would give levell to a mark, then rayſe up your ſight upon your rule till you may ſee the bottom of the mark even by the top of the diſpart, then ſee how many times that height of the Sight is contayned in the length of the Peece, from the Baſe-ring to the diſpart; and ſo much is the height you ſtand upon contayned in the diſtance to the mark.

An eaſie way to take a diſtance from a height onely with the Peece it ſelf.

Schol. I thank you for this eaſie rule, and alſo becauſe we ſhall not need to trouble our ſelves when ſervice is required, with many Inſtruments; but I feare I ſhall not conceive your meaning aright in this thing; therefore I will propound an example for my better help and ſatisfaction.

Suppoſe I ſtand upon a Plat-form or Mount, that I know to be 20 yards high, that is a ſcore; I take one of my Peeces being a Saker, or Demi-Culvering, and turn her to a ſhip at Sea which I am to ſhoot at, and being diſparted, I lay her levell towards the Ship, and I take my rule and I raiſe the ſight till I can ſee the bottom of the ſhip by the top of the diſpart, then I take that height of the ſight with a payre of Compaſſes, and that wideneſſe remaining, I try how many times that wideneſſe is contayned in the length of the Peece between the Baſe-ring and the diſpart, and I find it 48 times & a half; therefore I ſay the ſhip or mark is 48 ſcore and a half diſtant, whereby I know by the Table what allowance to give my Peece, be it Falcon, Saker, or Demi-Culvering; ſo I ſee that there cannot be a better rule then to take a diſtance from a height, then the Peece it ſelf.

This made plain by an example.

Note this well that except you know how much your Peece will carry it is in vain to take a diſtance.

Gun.

Gun. This is well done, and I see you conceive my meaning of this rule; and therefore I need not to trouble you with more examples in this kind; nevertheless, I will give you another rule with a Table of *Tangents* and *Secants*, whereby you may also perform this rule of taking a Distance more exactly if you will take a little paynes to understand me this Table will shew you how often the *Radius* is contained in any distance; but first you must know the names of the lines of this Triangle, called *Scalenum*, having 1 right Angle and two unequall sides, the Line making the right angle is called Perpendicular, the line making a right angle with this perpendicular, is called the *Basis*, or base line, the slope Diagonall

The Table.

M.	Min.	1 Deg.	2 Deg.	3 Deg.	4 Deg.	5 Deg.
1	3437	56	28 1/2	18 2/16	14 4/17	12 11/17
2	1718	55	28 1/2	18 1/16	14 1/17	11 11/17
3	1145	54	28	18 1/16	14 1/17	11 11/17
4	859	53	27 4/5	18 1/16	14 1/17	11 11/17
5	687	52 1/5	27 3/5	18 1/16	14	11 10/17
6	572	52	27 2/5	18 1/16	13 15/16	11 10/17
7	491	51	27	18 1/16	13 15/16	11 10/17
8	429	50	26 4/5	18 1/16	13 15/16	11 10/17
9	381	49 1/5	26 3/5	18 1/16	13 14/15	11 9/17
10	343	49	25 2/5	18	13 14/15	11 9/17
11	312	48	26 1/5	17 15/16	13 13/15	11 9/17
12	286	47 4/5	26	17 15/16	13 13/15	11 9/17
13	264	47	25 4/5	17 15/16	13 12/15	11 9/17
14	245	46	25 3/5	17 15/16	13 12/15	11
15	229	45 4/5	25 2/5	17 14/15	13 11/15	10 16/17
16	214	45	25 1/5	17 14/15	13 11/15	10 16/17
17	202	44 4/5	25	17 13/15	13 10/15	10 15/17
18	190	44	24 4/5	17 13/15	13 10/15	10 15/17
19	180	43	24 3/5	17 12/15	13 9/15	10 14/17
20	171	42 1/5	24 2/5	17 12/15	13 9/15	10 14/17
21	163	42	24 1/5	17	13 8/15	10 13/17
22	156	41 1/5	24	16 14/15	13 7/15	10 13/17
23	149	41	24	16 14/15	13	10 12/17
24	143	40 4/5	23 4/5	16 13/15	12 14/15	10 12/17
25	137	40	23 4/5	16 13/15	12 14/15	10 11/17
26	132	39 4/5	23 3/5	16 13/15	12 13/15	10 11/17
27	127	39 1/5	23 2/5	16 12/15	12 13/15	10 10/17
28	122	39	23 1/5	16 12/15	12 12/15	10 10/17

M.	Min.	1 Deg.	2 Deg.	3 Deg.	4 Deg.	5 Deg.
29	118	38 1/2	23	16 5/12	12 28/22	10 17/19
30	114	38	22 6/7	16 4/13	12 15/21	10 16/29
31	110	37 1/2	22 5/7	16 3/13	12 14/22	10 15/19
32	107	37	22 4/7	16 2/13	12 13/22	10 14/29
33	104	36 2/3	22 3/7	16 1/13	12 13/22	10 13/29
34	101	36 1/3	22 2/7	16	12 12/22	10 13/29
35	98	36	22 1/7	15 13/14	12 11/22	10 11/29
36	95	35 2/3	22	15 12/14	12 10/22	10 10/29
37	92	35 1/3	21 6/7	15 11/14	12 9/22	10 9/29
38	90	35	21 5/7	15 10/14	12 8/22	10 8/29
39	88	34 2/3	21 4/7	15 9/14	12 7/22	10 7/29
40	85	34 1/3	21 3/7	15 8/14	12 6/22	10 6/29
41	83	34	21 2/7	15 7/14	12 5/22	10 5/29
42	81	33 2/3	21 1/7	15 6/14	12 4/22	10 4/29
43	79	33 1/3	21	15 5/14	12 3/22	10 3/29
44	78	33	20 7/8	15 4/14	12 2/22	10 2/29
45	76	32 2/3	20 6/8	15 3/14	12 1/22	10 1/29
46	74	32 1/3	20 5/8	15 2/14	12	10
47	73	32	20 4/8	15 1/14	11 17/25	9 35/34
48	71	31 2/3	20 3/8	15	11 16/25	9 34/34
49	70	31 1/3	20 2/8	14 16/17	11 25/25	9 33/34
50	68	31	20 1/8	14 15/17	11 24/25	9 32/34
51	67	30 3/4	20	14 14/17	11 23/25	9 31/34
52	66	30 2/4	19 8/9	14 13/17	11 22/25	9 30/34
53	64	30 1/4	19 7/9	14 12/17	11 11/25	9 29/34
54	63	30	19 6/9	14 11/17	11 20/25	9 28/34
55	62	29 3/4	19 5/9	14 10/17	11 19/25	9 27/34
56	61	29 1/2	19 4/9	14 9/17	11 18/25	9 26/34
57	60	29 1/4	19 3/9	14 8/17	11 17/25	9 25/34
58	59	29	19 2/9	14 7/17	11 16/25	9 23/34
59	58	28 3/4	19 1/9	14 6/17	11 15/25	9 12/34
60	57	28 1/2	19	14 5/17	11 14/25	9 11/34

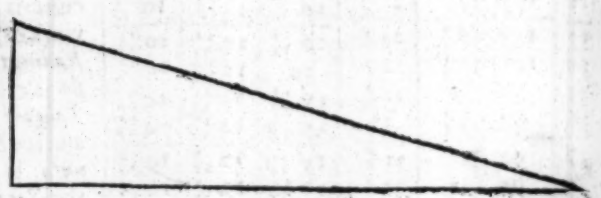
gonall line is called *Hypotenusa*, (againe) the Perpendicular is in this work called the *Radius*, the *Basis* is called the *Tangent* line, and the *Hipotenusa* is called the *Secant*; and thus you must learne to know the names and nature of these 3 lines of this *Triangle* wherof the *Radius* and *Tangent* is most usefull in this our work.

Another rule by the table of Tangents and Secants.

Schol. I thank you for this great paines, and I will see if I can understand the same, and first for the understanding of the *Triangle* which you call a *Scalenum*, containing one right Angle and two unequall sides, which I understand to bee after this manner:

A B *The Radius.* B C *The Base or* Tangent *line.* A C *The* Secant *or* Hipotenusa. A B C *The Right Angle.*

The demonstration.



80 160 960 1700 1240

Now this perpendicular making a right Angle in *A* is alwayes to signify the height whereon we ſtand, the Baſis being the Tangent line, alwayes ſheweth the diſtance. *viz.* How often this Radius or height is contayned in that line, which by the deg. of the Quadrant where the ſight to the mark cutteth the ſaid *Tangent*, which line is called the *Secant*, where the *Tangent* and *Secant* croſſe one another, there is the diſtance, and ſheweth how often the Radius or height is contayned in the Baſe line.

This I take to be your meaning concerning this Triangle, now I will propound an example or two concerning your Tables, ſuppoſe I ſtand upon a Tower or Rock that is 20 yards high, and I ſee a ſhip or mark which I ayme to ſhoot at, and I take my Quadrant and by the ſights I ſee the ſhip, and my plummet cuts 5 deg. 10 min. under levell, I look in the Table for 5 deg. in the head, and for 10 min. at the left ſide, and there I ſee 11 $\frac{4}{57}$. which ſheweth me that the Radius or height is contained 11 $\frac{4}{57}$ of the ſaid Radius, which is eleven ſcore and three quarters of a yard.

An Example propounded.

Alſo, ſuppoſe I ſtand 20 yards high, and ſee a mark that cuts 2 deg. 7 min. I look 2 deg. 7 min in the Table, and there I ſee the Radius 27, then I ſay the mark is 27 times the Radius, that is 27 ſcore, alſo at the ſame ſtanding I ſee a mark cut 1 deg. 6 min. and there

Another example

there I find the Radius 52, which is 52 ſcore, alſo at the ſame height I ſee a mark cut but 15 min. and there I ſee the Radius to be 229, and thus I think I underſtand you aright.

Gun. You have well performed this rule, and I perceive you do well underſtand me now, therefore if you will but take a ſquare ſuch as Carpenters uſe, and lay one ſide to a mark, and look ſidewayes by the other Leg or ſide, and there ſet a mark, then meaſure the diſtance between the two marks that ſhall be Radius, and ſo you may by this Rule take any diſtance upon any plain. An example of a ſide mark.

Schol. I give you moſt harty thanks, and if this manner of working be no harder then the other, it will prove a great eaſe for Gunners, though it be great paynes to your ſelf.

Therefore as I did before I will prove an example or two, ſuppoſe I ſtand upon a plain Plat-form no whit elevated, and I ſee a mark to which I am to ſhoot, I take any Square and lay it flat upon a joynt-ſtoole or other thing, and I direct one leg to the mark, then the Square unremoved I look ſidewayes by the other leg, and ſpie an other mark and meaſure the diſtance from my Square to the ſame, and I find it 15 yards which is Radius, then I take my Quadrant being fitted with ſights for ſuch a purpoſe, and ſtanding at this ſide-mark, I look to the mark whoſe diſtance I would know, I find my ſights cut 1 deg. 9 min. whereby I ſee the Radius to be contained 49 times and a half, ſo 15 yards being found 49 times and a half, which maketh 742 yards, that is 37 ſcore and 2 yards; and thus I underſtand this your work. The proofe of this example.

But for this uſe to take a diſtance, I think it were fit to have a Quadrant with an Index faſtened to the Center, whereupon are two ſights to direct the eye to any mark, which Quadrant may ſerve inſtead of the Square you ſpeak of before, and now I will try one example more, Suppoſe I am in a Fort or other place, and I ſee an Enemy or Troope maching towards me, and I am to make a ſhot to the ſame; now I take my Quadrant and look to the ſame, end withall I take a ſide mark, whoſe diſtance from my firſt ſtation is 20 yards, then by my ſights I look to the Troope or firſt mark, and my Sights cuts but 15 min. being a quarter of a deg. and there by the Table I ſee the Radius to be contayned 229 times, which is 229 ſcore, whereby I know my Ordnance will not reach them, and I let my Quadrant lye till I ſee by my Sights to cut 1

A distance without reach of the Ordnance.

deg. and there I see 56, which is 56 times the Radius, that is 56 score, and looking into my Table or *Randous*, I find a Saker to have 4 deg, a Demi-Culvering 3 and a half deg. a whole Culvering 3 deg. which I lay according as you taught me at the first, and for this your great paynes I heartily thank you, and will practice this course as occasion shall serve.

To take a distance with the Compasses.

But I have seen you use a payre of Compasses for this purpose, of which I pray you shew me the use also, for though any one of these wayes you have shewed me may be sufficient, yet I would gladly learne that Rule, which though it were devised by your self, yet I have heard that the King liked it so well, that he highly commended the same when you shewed it to his Majesty at your Fort called *Mots*-Bulwarke.

Gun. I would willingly do this, but because as you say I have shewed it to his Majesty my dread Soveraigne, I will be sparing in revealing the knowledge thereof; but yet I will so explain the same, that a good Artist may well understand my meaning, but I have been abused in this thing, for I chanced to declare the manner of this taking a Distance with the Compasses, to a very speciall friend, who shewed it to one Mr. *Babington*, which hath put the same in his own name in Print, in his book of Gunners-Art and Fire-works; which I take unkindly: In which book you may see the same described, but the reason of the Rule, and upon what proposition in *Euclid* it doth depend, he hath not declared; because it may be he knoweth it not: But I was driven before his Majesty to prove the truth of the Rule and the Proposition whereupon it depended, and then his Majesty did highly commend thereof.

The Author hath been abused in this thing.

Schol. Because you say the Kings Majesty liked it so well, I am so much the more desirous to know the same, I pray you therefore give me some directions how I may understand the same, and I will do my best to find it out of my self; and so I will trouble you as little as I can.

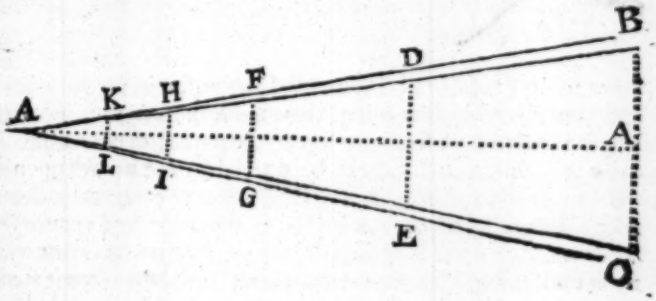
This is the ground of the *Sector*.

Gun. This is the ground of an Instrument called the *Sector* so learnedly described and set forth by Mr. *Gunter*, in a large book of his concerning the said Instrument.

Describe the Triangle called *Isosceles*, which hath onely two equall sides, being represented by the letters A B. and A C. then seeing

eeing theſe two *A B* and *A C.* are equall, their Sections *A D* and *A E* muſt needs be equall, and ſhall be cut proportionally, and if we draw the lines *B C.* and *D E.* they will be parallel by the ſecond propoſition of the 6 book of *Euclid*, and ſo the Triangle *A B C.* and *A D E.* ſhall be Equiangle by reaſon of the common Angle at *A.* and the equall Angles at the Baſe; and therefore ſhall have the ſides alſo proportionall, about thoſe Angles by the fourth propoſition of the ſixt book of *Euclid*, and ſo the ſide *A D.* ſhall be to the ſide *A B.* as the Baſis *D E.* is unto the Parallel Baſis *B C.* and by converſion, *A B.* ſhall be unto *A D.* as *B C.* unto *D E.* and by permutation *A D.* ſhall be unto *D E.* as *A B.* to *B C.* &c. So that if *A D.* be the fourth part of the ſide *A B.* then *D E.* ſhall alſo be the fourth part of his Parallel Baſis *B C.* the like reaſon holdeth in all other Sections.

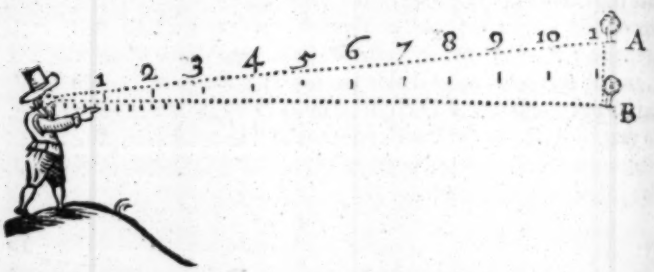
The ſecond Propoſition of the ſixth booke of *Euclid.*



The Demonſtration.

Here you ſee that as often as *D E.* is contayned in *A D.* or *A E*, ſo often is *B C.* contayned in *A B.* or *A C.* for as the line *D E.* is contayned 3 times in *A D.* or *A C*, ſo is the line *B C.* contayned 3 times *AC* or *A B*, and upon this ground I hold my Propoſition, that if I take a payre of Compaſſes in my right hand, and ſtanding upright with my body, and opening my Compaſſes to the length of any known line or mark, ſtretching out my arme ſtreight then look how often the opening of my Compaſſes is contayned from the poynts of the ſame to my eye, ſo often is the length of the known line or mark contayned in the diſtance to my ſtanding, and therefore mark this well.

Schol. This I confeſſe is very hard, too hard for me as yet to conceive, but I will aſſay to prove it by an example. ſuppoſe I am to make a ſhot to a ſhip or a Barque at Sea, whoſe Diſtance I deſire to know, and I know the Barque to be 20 yards long, from the



Stern to the Beake head, I take my Compaſſes in my right hand, and then Stretching out mine Arme to his full length, I find the length of mine Arm from my Eye to the poynts of my Compaſſes to be 30 inches, which I alway keep and do make a mark upon my ſtaffe or walking ſtick, which ſhall alwayes continue with me; now I ſtretch out my Arm with my Compaſſes, and open or ſhut the ſame to the juſt length of the ſhip or Barque, and that wideneſſe remaining, I ſee upon my walking ſtick, how often it is contayned from the end of my ſtick to the mark, which I made, being the diſtance of my eye to the points of my Compaſſes, and I find it 58 times, then I ſay, the mark or ſhip being 20 yards which is a ſcore, then I ſay that the ſhip is 58 ſcore off; and I muſt give a Demi-Culvering almoſt 4 degrees to reach the mark.

This explayned by an example.

And by this I ſee that the practick is much eaſier then the Theorick; and now I think I underſtand this I will make me a Scale of ſome 6 inches long, and divide every inch into 16 parts and ſo account how many times every part is contayned in 30 inches, for this being a true and plain rule, it is worthy to be much accounted and for the which I do moſt heartily thank you, for I think you have taught me this Art of ſhooting in great Ordnance, from the firſt to the laſt very faithfully, and plainly, wherein I will be to you a diligent and thankfull Scholler.

The practick eaſier then the Theorick.

Gun-

Gun. I perceive you do partly underſtand this Rule of taking a Diſtance with the Compaſſes, but yet there is much more knowledge belonging to this thing, for by this you may exactly draw any proſpective Plat, of any Town, Caſtle or Fort, that offers it ſelf to your view or ſight, though you cannot come neere it by a mile or more, and deſcribe all the Churches, Towers, Forts and Bulworks, or Rampiers belonging to the ſame; according to the proportion of their bredth and heighth, and by knowing the true diſtance of any two places, all the reſt is known; and in a word, whatſoever may be performed by any other Mathematicall Inſtrument concerning the Art of Fortifications may more truer be performed by this rule of the Compaſſes, with a Scale belonging thereto; but I will ceaſe to ſpeak thereof till a more convenient time, and will draw now to a concluſion of what hath been ſpoken.

To draw the Proſpective Plate of a Caſtle, Towne or Fort.

Firſt, you ſee by the former diſcourſe in the beginning of this work, that he that doth undertake to be a profeſſed Gunner, muſt above all things learn to ſerve God, and to behave himſelf quietly and gently amongſt all men, eſpecially amongſt his fellow Gunners; the next thing is to know his Peece, as whether it be Faloon, Saker Demi-Culvering or the like; to know her ſoundneſſe, her cleerneſſe from flawes, crackes or hony-combes; her height both at the Baſe ring and mouth, the height of the bore, the length of the Peece, the fortification in the Chamber, the length of the diſpart, and the weight of the Peece; and to name all the parts both of the Peece and Carriage, as you may ſee to be deſcribed in the firſt part of the Book, then to name his Plat-formes or Mounts, to mark or number his Peeces, to ſee they be well mounted in their Carriages, to charge or load his Peece gracefully, quick and nimbly; and to make him a Table with the Randons of all his ſeverall Peeces of Ordnance under his charge, and finally to learne to know the diſtance to his mark, and to write down all his ſhot that he maketh from time time.

The concluſion of all this wrrk.

An admonition to diligent Gunners.

Theſe things ought a diligent Gunner to practice for the ſervice of the King and State, the Honour of his Generall or Captain of his Fort, and alſo for his own credit, and herein he ſhall ſhew his Loyalty to his Superiors, and his carefull diligence to all men.

A Table of Randons calculated for every quarter of a Degree of the Quadrant in Yards, Scores and Miles, for these three Peeces.

		Whole Culvering.			*Demi-Culvering.*			*Saker.*		
	lev.	Score	Yards	Miles	Yard	Score	Miles	Yard	Score	Mile.
	Mil	460	23	0	400	20	0	360	18	0
	¼	515	25 15	¼ mil	450	22 10	¼ mil	405	20 5	0
	½	570	28 10	0	500	25 0	0	450	22 10	¼ mil
	¾	625	31 5	0	550	27 10	0	495	24 15	0
1 Deg.	1	630	34	0	600	30 0	0	440	27 0	0
	1 ¼	735	36 15	0	650	32 10	0	585	29 5	0
	1 ½	790	39 10	0	700	35 0	0	630	31 10	0
	1 ¾	845	42 5	0	750	37 10	0	675	33 15	0
2 Deg.	2	900	45	¼ mil	800	40 0	0	720	36 0	0
	2 ¼	955	47 15	0	850	42 10	0	765	38 5	0
	2 ½	1010	50 10	0	900	45 0	¼ mil	710	40 0	0
	2 ¾	1065	53 5	0	950	47 10	0	865	43 5	¼ mil
3 Deg.	3	1120	56	0	1000	50 0	0	910	45 10	0
	3 ¼	1175	58 15	0	1050	52 10	0	955	47 15	0
	3 ½	1230	61 10	0	1100	55 0	0	1000	50 0	0
	3 ¾	1285	64 5	0	1150	57 10	0	1045	52 5	0
4 Deg.	4	1330	66 10	¾ mil	1200	60 10	0	1090	54 10	0
	4 ¼	1385	69 5	0	1250	62 10	0	1135	56 15	0
	4 ½	1240	72	0	1300	65 0	0	1180	59 0	0
	4 ¾	1495	74 15	0	1350	67 10	¼ mil	1225	61 5	0

A Table of Randons calculated for every quarter of a Degree of the Quadrant in Yards, Scores and Miles, for these three Peeces.

	Elev.	Whole Culvering. Score	Yards	Miles	Demi-Culvering. Yard	Score	Miles	Saker. Yard	Score	Mile.
	Mil	460	23	0	400	20	0	360	18	0
5 Deg.	5	1460	77 10	0	1400	70	0	1270	63 10	0
	5 1/4	1605	80 5	0	1450	72 10	0	1315	64 15	0
	5 1/2	1660	80 3	0	1500	75 0	0	1360	68 0	1/4 mil
	5 3/4	1715	85 15	0	1550	77 10	0	1405	70 5	0
6 Deg.	6	1770	88 10	1 mil.	1600	80 0	0	1450	72 10	0
	6 1/4	1825	91 5	0	1650	82 10	0	1495	74 15	0
	6 1/2	1880	94	0	1700	85 0	0	1520	70 0	0
	6 3/4	1935	96 15	0	1750	87 10	1 mil.	1585	79 5	0
7 Deg.	7	1990	99 10	0	1800	90 0	0	1630	81 10	0
	7 1/4	2045	102 5	0	1850	92 10	0	1675	83 15	0
	7 1/2	2100	105 0	0	1900	95 0	0	1720	86 0	0
	7 3/4	2155	107 15	0	1950	97 10	0	1765	88 5	1 mil.
8 Deg.	8	2210	110 10	1 mil. 1/4	2000	100 0	0	1810	90 10	0
	8 1/4	2265	113 5	0	2050	102 10	0	1855	92 15	0
	8 1/2	2320	116	0	2100	105 0	0	1900	95 0	0
	8 3/4	2375	118 15	0	2150	107 10	0	1945	97 5	0
9 Deg.	9	2430	121	0	2200	100 0	0	1990	99 10	0
	9 1/4	2485	124	0	2250	112 10	1/4 mil	2035	101 15	0
	9 1/2	2540	127	1 mil. 1/4	2300	115 0	0	2080	104 0	0
	9 3/4	2595	129 15	0	2350	117 10	0	2125	106 5	0
10	10	2650	132 10	0	2400	120 0	0	2170	108 10	0

The uſe of this Table.

YOu ſee this Table is made for theſe three Peeces, *viz.* The Culvering, the Demi-Culvering, and the Saker; as you may ſee written in the head of the Table, and under the name of each ſeverall Peece the diſtance that it doth carry levell, and what they will carry upon the Mount of every quarter of a degree, in Yards, Scores, and Miles; and ſo proceeding downward from a ¼ to ¼, and three quarters, and to a whole degree and his parts, and ſo to ten degrees and parts; and the numbers anſwering to the ſame doth ſhew the diſtance, the firſt in yards, the ſecond in ſcores, and the third in miles, as you may ſee in the Table.

An Example.

AS for example, a Culvering being mounted two degrees and three quarters, will carry 1065 yards, that is 53 ſcore and five yards, that is above halfa mile, a Demi-Culvering at that advantage will carry 950 yards, that is 47 ſcore 10 yards, being above a quarter of a mile, the Saker at that allowance will carry 865 yards, that is 43 ſcore and 5 yards, almoſt halfa mile, and of any other degree as you ſee in the Table at the firſt ſight, without the which, this is very hard and troubleſome to be performed; but by this, many queſtions may be reſolved, being a thing that as yet I could never ſee ſet down in writing by any man in any Language.

What inches will make a degree.

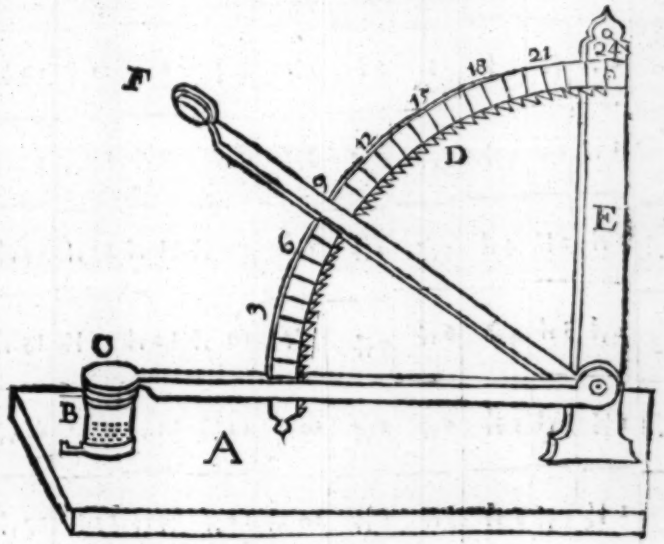
Here followeth a Table ſhewing what Inches and parts of an inch doth make a degree of the Quadrant, according to the length of the Peece, the reaſon hereof is this.

The way to make this Table.

YOu muſt firſt meaſure the length of the Peece from the Baſe-Ring to the Muſſel-Ring, and put that into inches, then double thoſe inches, and multiply thoſe inches ſo doubled by 22, and divide that by 7, and note what the Quotient is, which Quotient divide by 360 the degrees of a Circle, and that laſt Quotient ſhall ſhew the number of inches, and parts that will make a degree of

of the Quadrant in a Peece of ſuch a length; this is a worthy and ſpeciall rule to be obſerved of all diligent and induſtrious Gunners.

An Inſtrument uſed for the proof of Powder deſcribed in Pag. 25.



A *The baſe of the Engine,*
B *The Gunne or Box,*
C *The cover for the Box:*
D *The quarter of the Circle of Braſſe.*
E *The Standard,*
F *The cover blown up to 9.*

Theſe Inſtruments with others, are made by *Mr. Flower,* dwelling in the *Bulwark* neere the Tower.

The Table shewing what Inches and parts of the Sight to the length

Lengt of the Peece	1	2	3	4	5	6	7	8	9	10
5 1/2	1 7/11	2 3/11	3 9/11	4 6/11	5 2/11	6 8/11	7 11/11	9 1/11	10 7/11	11 4/11
6 00	1 1/4	2 1/2	3 1/4	5	6 1/2	7 1/2	8 3/4	10	11 1/4	12 1/2
6 1 2	1 9/11	2 8/11	4 7/11	5 6/11	6 8/11	8 5/11	9 4/11	10 3/11	12 2/11	13 1/11
7 ..	1 1/11	2 10/11	4 4/11	5 3/11	7 1/11	8 9/11	10 3/11	11 7/11	13 7/11	14 6/11
7 1/2	1 6/11	3 1/11	4 7/11	6 3/11	7 8/11	9 5/11	10 2/11	12 4/11	13 10/11	15 7/11
8 ..	1 7/22	3 3/11	5 1/11	6 8/11	8 3/22	10 1/11	11 7/22	13 5/11	15 3/22	16 9/11
8 1/2	1 27/88	3 6/11	5 7/88	7 5/11	8 33/88	10 7/11	12 3/88	14 1/11	15 33/88	17 4/11
9 ..	1 1/11	3 9/11	5 8/11	7 7/11	9 2/11	11 7/11	13 3/11	15 1/11	17 5/11	19 7/11
9 1/2	2.	4.	6	8	10	12	14	16	18	20
10 ..	2 1/11	4 1/11	6 3/11	8 4/11	10 5/11	12 6/11	14 7/11	16 8/11	18 9/11	20 10/11

Rule will make a Degree of the Quadrant, according of the Peece.

Leng of the Peece	1	2	3	4	5	6	7	8	9	10
10 1/2	2	4	6	8	10	13	15	17	19	21
11	2	4	6	9	11	13	15	18	20	22
11 1/2	2	4	7	9	12	14	16	19	21	24
12	2	5	7	10	12	15	17	20	22	25
12 1/2	2	5	7	10	13	15	18	21	23	26
13	2	5	8	10	13	16	19	21	24	27
13 1/2	2	5	8	11	14	16	19	22	26	29
14	2	5	8	11	14	17	20	23	26	29
14 1/2	3	6	9	12	15	18	21	24	27	30
15	3	6	9	12	15	18	21	25	28	31

The Table shewing what Powder both of Corne and Serpentine from 1 to 20, and

The Number of Shot.	1	2	3	4	5	6	7	8	9
The Canon of 7 ¼. Serp.	40	80	120	160	200	240	208	320	360
The Canon of 7 ¼ Corn-powder.	27	54	81	108	135	162	189	216	243
Canon of 7 Serpent.pow	34	68	102	136	170	204	238	272	306
Canon of 7 Corn-powd.	18	36	54	72	90	108	126	144	162
Demi-Canon 6 y. ½ Serp	25	50	75	100	125	150	173	200	225
Demi-Can. of 6 ¼ Corn.	16	32	48	64	80	96	112	128	144
Culvering Serpentine.	18	36	54	72	90	108	126	144	162
Culvering Corne.	12	24	36	48	60	72	84	96	108
Demi-Culvering Serp.	9	18	27	36	45	54	63	72	81
Demi-Culvering Corne.	6	12	18	24	30	36	42	48	54
Saker Serpentine,	5 ¼	10 ½	15 ¾	21	26 ¼	31 ½	36 ¾	42	47 ¼
Saker Corne.	3 ½	7	10 ½	14	17 ½	21	24 ½	28	31 ½
Minnion Serpentine.	4	8	12	16	20	24	28	32	36
Minnion Corne.	2 ¾	5 ½	8 ¼	11	13 ¾	16 ½	19 ¾	22	24 ¾
Falcon Serpentine.	2 ¼	4 ½	6 ¾	9	11 ¼	13 ½	15 ¾	18	20 ¼
Falcon Corne-powder.	2	4	6	8	10	12	14	16	18
Falconet Serpentine.	1 ¼	2 ½	3 ¾	5	6 ¼	7 ½	8 ¾	10	11 ¼
Falconet Corne.	1	2	3	4	5	6	7	8	9
Rabbinet Serpentine.	¾	1 ½	2 ¼	3	3 ¾	4 ½	5 ¼	6	6 ¾
Rabbinet Corne powder	½	1	1 ½	2	2 ½	3	3 ½	4	4 ½
Cannon Perier Serpent.	11	22	33	41	55	66	77	88	99
The Canon Perier corne (of 8 inches.	9	18	27	36	45	54	63	72	81
Port Peece Brasse, corne,	2 ½	5	7 ½	10	12 ½	15	17 ½	20	22 ½
Fowlers Chamber corne.	1 ½	3	4 ½	6	7 ½	9	10 ½	12	13 ½

will load any Peece of Ordnance, from a Cannon to a Rabinet, so to a 100.

10	11	12	13	14	15	16	17	18	19	20	100
400	440	480	500	560	600	640	680	720	760	800	4000
270	297	324	351	378	405	432	459	486	513	540	2700
340	374	40	432	466	500	584	568	602	636	670	3350
180	198	216	274	252	270	288	306	324	342	360	1800
250	275	300	325	350	375	400	425	450	478	500	2500
160	176	192	208	224	240	256	275	288	304	220	1600
180	198	216	234	252	270	288	306	324	342	360	1800
120	132	144	156	168	180	192	204	216	228	240	1200
90	99	108	117	126	135	144	153	162	171	180	900
60	66	72	78	84	90	96	102	108	114	120	600
52 1/2	57 3/4	63	68 1/2	73 1/2	78 1/2	84	89 1/4	94 1/2	99 1/2	105	525
35	38 1/2	42	45 1/2	49	52 1/2	56	59 1/2	64	62 1/2	71	355
40	44	48	52	56	60	64	68	72	76	80	400
27 1/2	30 1/4	33	35 1/4	38 1/2	41 1/2	44	46 3/4	49 1/2	52 3/4	55	275
22 1/2	24 1/4	27	29 1/2	30 1/2	33 1/2	36	38 1/2	40 1/2	42 1/2	45	225
20	22	24	26	28	30	32	34	36	38	40	200
12 1/2	13 1/2	15	16 1/2	17 1/2	18 1/4	20	21 1/4	22 1/2	23 1/2	25	125
10	11	12	13	14	15	16	17	18	19	20	100
7 1/2	8 1/2	9	9 3/4	10 1/2	11 1/4	12	12 3/4	13 1/2	14 1/2	15	75
5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	50
110	121	132	142	154	165	176	187	198	209	220	2100
90	99	108	117	126	135	144	153	162	171	180	900
25	27 1/2	30	32 1/2	35	37 1/2	40	42 1/2	45	47 1/2	50	250
15	16 1/2	18	19 1/2	21	22 1/2	24	25 1/2	27	28 1/2	30	150

The Number of the shot	1	2	3	4	5	6	7	8	9
The weight of the Cannon shot of 7 ½.	63	126	189	29-	315	37[illegible]	441	504	565
The weight of the Cannon shot of 7 ½ in poun.	4	94	141	188	235	282	329	37[illegible]	423
The Canon pierier shot of 7 ½ of stone in pounds	24	48	72	96	120	144	108	192	216
The weight of the Demi Can shot of 6 in pound	27	5[illegible]	81 ½	109	135 ½	163	189 ½	217	243 ½
The weight of the Culvering shot in pounds.	18	30	54	72	90	108	126	144	162
The weight of the Demi Culver. shot in pounds	9	18	23	36	45	54	63	72	81
The weight of the Saker shot in pounds.	5 ½	10 ½	15 ½	21	26 ½	31 ½	36 ½	42	47 ½
The weight of the Minion shot in pounds.	4	8	12	16	20	24	28	32	56
The weight of the Falcon shot in pounds.	2 ½	4 ½	6 ½	9	11 ½	13 ½	15 ½	18	20 ½
The Falconet shot in po.	1 ½	2 ½	3 ½	5	6 ½	7 ½	8 ½	10	11 ½
The Rabbinet shot in pounds and ounces.	½ l.	1 l. ½	2 l. ½	3 l.	3 l. ½	4 l. ½	5 l. ½	6 l.	6 l. ½
The weight of the Base shot in pounds and oun.	6 oũ	½ l.	1 l. 2 ounc.	1 l. ½	1 l ½ 2 oun	2 l. ½	2 l. ½ 2 oun	3 l.	3 l. ½ 2 oun
The Fowler shot in pounds and ounces.	6 l. 3 oũ	12 l. 6 oun	18 l. 9 oun	24 l. 12 ou	30 l. 15 ou	37 l. 2 oun	43 l. 5 oun	49 l. ½	55 l. ½ 3 oun
The Port Peece in poun.	11 ½	22 ½	33 ½	45	56 ½	67 ½	78 ½	100	111 ½
How many Hargubus of Crock shot in pounds and ounces.	1	2	3	4	5	0	7	8	9
	7 ½	14 1 ou	21 1 ½	28 2 oun	35 2 l. ½	42 3 l.	49 3 l. ½	56 4 l.	60 4 l. ½
How many Musket shot in pounds and ounces.	11	22	33	44	55	66	77	88	99
How many Caliver shot in pounds and ounces.	20	40	60	80	100	1 20	140	160	180

Cannon to the Caliver from 1, *to* 20, *and so to* 100.

10	11	12	13	14	15	16	17	18	19	20	100
630	693	756	819	882	945	1008	1171	1194	1257	1260	6300
470	517	564	611	658	705	752	799	893	940	987	4935
240	264	288	312	336	360	384	438	431	456	480	2400
271	298 ½	325	351 ½	379	405 ½	433	459 ½	487	513 ½	540	2700
180	198	216	234	252	270	288	306	324	342	360	1800
90	99	108	117	126	135	144	153	162	171	180	900
52 ½	57 ½	63	68 ½	73 ½	78 ½	84	89 ½	94 ½	99 ½	105	525
40	44	48	52	56	60	64	68	72	76	80	400
32 ½	24 ½	27	29 ½	31 ½	33 ½	36	38 ½	40 ½	42 ½	45	225
12 ½	13 ½	15	16 ½	17 ½	18 ½	20	21 ½	22 ½	23 ½	25	125
71. ½	81. ½	9 l.	9 l. ½	10 l. ½	11 l. ½	12 l.	13 l. ½	13 l. ½	14 l. ½	15	75
3 l. ½	4 l. 2 oun	4 l. ½	4 l. ½ 2 oun	5 l. ¾	5 l. ½ 2 oun	6 l.	6 l. ½ 2 oun	6 l. ½	7 l. 2 oun	7 l. ½	35 ½
68 l. ½ 3 oun	68 l. 1 oun	74 l. ½	80 ½ 3 oun	86 l. ½ 2 oun	22 l. ½ 1 oun	99 l.	105 l. 3 oun	111. ½ 2 oun	117 l. 1 oun	123 l. ½	615 ½
122 ½	133 ½	145	156 ½	167 ½	178 ½	190	200. ½	211. ½	222 ½	234	613 ½
10	11	12	13	14	15	16	17	18	19	20	
75 5 l.	77 5 l. ½	84 6 l.	91	105	112 8 l.	119	126	133	140		
100	121	132	143	154	165	176	187	198	209	220	1100
200	220	240	260	280	300	320	340	360	380	400	2000

The cause and reason of the Tables.

I have set down these Tables for the good and profit of those that desire to be expert in this Art, hoping that those into whose hands this may come, will accept thereof, and take in good part this my care and industry in setting forth these things in so plain and easie a way; neither have I troubled my Readers with impertinent things: but have followed the truth in all things, as neer as God and my 50 yeeres Experience hath directed me, and I could never yet in my judgement find a better way wherein to insist then this, for I have conferred with the best Arts-men in this faculty that I could light upon, both *French*, Low and high-*Dutch*; I have seen and read most mens books or works, both *French*, *Latine* and *English*; and I find that the book written by *Vfano* Captain of the Artillery of *Antwerp* Castle, to be the best that ever I have seen of that subject, which book, Mr. *Norton* hath much immitated; but yet I could never see in them nor any other book, any true Table of *Randons*, nor any easie way to take a distance; both which I have plainly and easily performed in this discourse, for surely without this knowledge. *viz.* The *Random* or execution of the Peece, and the Distance to the mark, a man may continue a blind Gunner all the dayes of his life.

Vfano the best book I have seen of this Art.

Without the *Random* of the Peece and the distance to the mark, a man can never be a perfect Gunner.

I have heard many great braggers (of which there be too many belonging to this service) I say they will brag what good shot they have made, and how neere the mark; but then ask them the distance to the mark, and what allowance the Peece had to make such a faire shot; nay, then they cannot tell: but these men will jeere, and mock, and abuse an Arts-man to his face, and also disgrace him behind his back; and yet continue a blind foole himself.

No easie matter to be a good Gunner.

Therefore I wish all good Gunners and Arts-men to practice diligently what I have written in this book, and let not that man that will be a Gunner think it an easie matter; for it is a thing of the greatest consequence in an Army; and much trust is required and imposed in a good Gunner; as you may see in this examination following, taken out of *Vfano* Captain of the Artillery of *Antwerp* Castle.

The

The examination of a Gunner pretending the place of a Constable or Master Gunner of the field. Vsano.

Generall.

MAster Lieutenant, I think you know with what instance the Gunner named N. have required me to grant him the place of Mr. Gunner, newly fallen at the Battery of *Ravaline*, a thing that I cannot well deny him; but I would first know of you whether he be a man of good desert and carriage, and whether he be sufficient to undergoe such a charge; because I think you doe know him better then my self.

Behold here the care of a good Commander.

Lieutenant.

Right Honourable, I have known this man a long time, and have alway found him to be in his carriage both Gentile and kind to all men, and skilfull in the Art of Artillery; that by my advice he doth well deserve to be honoured and graced with this place for he hath vertue and experience joyned together, which I doe verily think will appeare in his examination most plainly.

A loving and kind answer of a Lieutenant.

Gen. Well then let him be called that I may prove him by some questions.

You are welcome brother; because I would be informed of your good services, I desire to make experience and proof of your practice, and to understand the discourse of your experience in the Warres; for he that will aspire to the charge of a Mr. Gunner ought to have both knowledge and practice joyned together, as well to discharge his duty in his place as to teach and instruct those his Gunners that serve under him; now I demand of you what is Artillery?

Knowledge & practice ought to be in a Mr. Gunner.

Gunner.

My Lord, Artillery is an Engine of great account and reason, weight, and measure, and a most admirable invention to throw down and ruine the strong and proud walls of Fortresses, Cityes, and Castles in time of service.

The definition of Artillery.

Gen. And what is a Gunner in this businesse or service?

Gun. The Gunner is a man that is exercised, and hath knowledge and experience in that Art.

What is a Gunner.

Gen. Tell me then how we shall make a battery, and in what

How to trace out the Plat-formes with the measure of the same.

sort shall we trace out the Plat-formes for the same?

Gun. Right Honourable, as concerning the Platformes, they ought to be made in such proportion, as for the receyle of a Cannon of battery, they ought to be 30 Geometricall foot, and for the Demi-Cannon 27, accounting for the first planck of the Cannon Plat-form next the Tronier to be 9 foot long, and for the Demi-Cannon 8 foot, and the rest of the planeks to increase in a streight line to the last, which ought to be double the length of the first.

Gen. This is well answered, but now also tell me what height and thicknesse we ought to give to the Spaul or shoulder, before the Ordnance, which must serve for the covering or defence of the battery in such sort that it may be Cannon proofe, and in what forme will you make out the Troisners for every Peece?

The thicknesse of the shoulder

Gun. The shoulder my Lord must be made of earth and faggots, in thicknesse 23 foot, giving to every foot high of Faggots, 2 foot of earth, and so laying upon laying till we come to the height of 11 foot, and when we come to the height of 3 foot, to set out the Troisners in such sort and measure, that for the Cannon we allow for the Barbe or the place where we put out the mouth of the Peece, in bredth 3 foot within, and with out 12 foot, in such manner, that from the beginning of the place or entry within, to the place of the wideneſſe without of 12 foot; the ground goe falling and descending, or slanting by a scarpe, to the end that the Peece may the better discover the Enemy upon all occasions, and may offend more freely and liberally; and this is also to give the Peece more roome to soffle or to blow, lest if the Troisners be not of a sufficient wideneſſe the peece may blow up all.

The Barbe.

Gen. You speak not much from the purpose, but now tell me, what covering will you give to a Demi-Cannon?

Gun. We must begin the Tronier as for the Cannon. *viz.* 3 Foot high from the Plat-form, but within it is to be but 2 foot and a half, and the splay 9 foot, and the same descent, that is allowed for the Cannon.

The covering of the Demi-Cannon.

Gen. Say we should make a simple battery with Gabions how many would you demand for that purpose?

Gun. According as the places will permit, and the number of Peeces to be lodged.

Gen. Let us make account to lodge 12 Peeces.

Gun.

Gun. Then in placing three Gabions between every Peece, and for more safety of being discovered of the Enemy, and also to cover the out ends, I demand 39, but if the place be too little, in such sort that we can place but 2 Gabions between each Peece, we may be contented with 26, and also in that of 39, from one Tronier to another, to be 22 foot, and in this of 26 to be but 14 foot, and the Peeces to be lodged between the 3 Gabions, to be 15 foot from Wheele to Wheele, but those that are lodged between two Gabions to be but 14 foot from Wheele to Wheele, making account that every Gabion is 7 foot thick.

39 Gabions to cover 13 Peeces.

Gen. But if this should be made a battery of proof, how many Gabions would you demand to make such a covert?

Gun. It is a hard matter to make a battery Cannon proof with Gabions, except they be well accommodated, and the coverture carefully handled; nevertheless, to satisfie your Lordships demand, and to discover a little what I do apprehend, I demand for both the 2 sorts, double the quantity, so as in the first order of 3 between 2 Peeces, I would place 3 also in a Trianguler form in the front, covering the 2 joynts of the 3 that are innermost with 2 Gabions, and those 2 again with one, placing between every Peece 9 Gabions, and so for the 39, which I demanded for a single battery, I would demand 78 &c for the other of 2 to make a Trianguler form, and to cover the joynts of the other; for this I demand but 39, and I am assured it will be as good as the other.

A hard matter to make a battery Cannon proof with Gabions.

Gen. Wherefore give you unto the espaul made with earth and faggots 23 foot in thickneſſe, and to these of Gabions 3 and 3, and no more then 20 foot in his greatest thickneſſe?

Gun. The Gabions being well filled with earth, grasse and other things, so that they be not mingled with stones, being well ordered and well beaten or rammed, are as it were 3 separated bodies enterlaced with the ayre, and it is a certain thing that the Ball having pierced the one, shall encounter the Ayre between the second, and so lose much of his forge, in such sort, that by this meanes I esteem that the default of 2 foot is well recompenced, and the espaul of earth and faggots making but one intire body, without the intermixtion of the Ayre, and chiefly when the Ball happeneth into the laying of the faggots will make his passage more easily, so that the two foot which is more then the Gabions, will come all to one point or reckoning.

Gen. The reasons that you give me in this thing is not much from the purpose; but now tell me in what batteries you have served and how you have got your experience.

The places where the Gunner hath served.

Gun. My Lord, I have served at the Siege of *Cambray*, at *Cales*, at St. *Andrea's*, and the famous journeyes of *Hulst*, and *Ostend*, and now lately at *Maktendont* and *Craque*, and also here now under your Lordship.

Gen. Now I perceive you are an old Gunner, and are worthy of a recompence for your service; I would also know of you before you are advanced to the charge of a Mr. Gunner, what duties you are to performe in this your charge in case of Batteries.

The duty or Office of a Mr Gunner.

Gun. A Master Gunner that taketh charge at a battery, or in the Field, is bound to performe generally all these things above said; & in particular to set out his Troisners, to place well his Gabions for his covertures, to see that they be well beaten and rammed, and for his espauls, to set them out himself, and to measure them with his own proper Cords, and to mark them to the workmen in lines, streight and Traverse. *Item*, to make and levell out his Plat-forms, to visite his Peeces, to know the goodnesse or defects thereof, to make the Ladles, Spunges, Rammers and Tampions for all manner of Peeces, to know the goodnesse or defect of Powder, and to see that every Peece have his charge, to Caliper his shot and to sort them out for every Peece, allowing necessary vent, to fit the matches, to cover well the Powder from the possession of the Enemies shot and to place the same under the wind from the battery a pretty distance, in such sort that the sparks come not to the Powder.

Item, to see that the point that the Gunners doe use in shooting be right and good, being directed to the foot of the thing they shoot at, also to divide the handropes and Match among the Gunners, to distribute and appoint the Peeces in the batteries, & to admonish the Gunners that they fayle not in any point, to solicit for their Munition bread and other refreshings, as well for those that are ordinary as extraordinary. To receive their pay of the paymaster or master of the Camp or quarter, and to deliver the same into every severall mans own hands, giving them charge every one to doe their duty, this being the Gunners carefulnesse in their places.

Gun.

Gen. You shew your self sufficient for such a place, and I see not but the answers you have made me to all those questions that I have made and propounded are very good, and sufficient, for a good Theory is the ground and foundation of a good Practick. Well now Mr. Lieutenant, doe you examine the rest of that which is requisite, and for the place he pretendeth; let him, him have it, I accept thereof, and will give a billet to the Auditor that he may place him in his book, to the end he may be allowed in his pay and admitted for a Master Gunner with all priviledges belonging to the same.

The allowance and admitance of the Master Gunner.

Lieut. My Lord, I will doe your commandement in these things.

Gen. Adiew till to morrow.

Lieut. Tell me me now my good friend, how many Names and things do belong to a Peece of Artillery?

Gun. The things belonging to a Peece of Artillery are in number 21, when they are required to be named, of the which the Mouth is the first and principall, and that whereupon dependeth the whole fabrick and proportion both of Peece and Carriage, and from thence is derived all the composition of the Peece, as well in the molds for the Founder, as for any other thing, the height of the Bore or diameter of the same are called the Caliber, from whence the Gunner doth take all the proportion of the Peece, the vent for the shot, the weight thereof; and how much powder fine or common, will charge the said Peece; the great end of the mouth is called the Orle or the Hem, and the smooth mettal along the Peece to the Frises is called the Brocall, this by meanes of the force of the powder and repulse of the shot, causeth the recoyle of the Peece when it is discharged; the ayme or shole, and all the Cilender or hollow of the Peece bears the name of ayme or Cilender, if the Peece be not Bell or Chamber bored, but if it be Chambered it is called (*curie frise*) the place to give fire is called the Touch-hole, the breech is the most highest part of the mettal and the greatest of the Peece, the part or aftermost of the mettal that is behind is called the Cascabell, or of some Gunners the Carnouse, the Rings or Circles that encompasse the Peece as well for ornament as for strength are called Frises.

The names & things belonging to a Peece are 21 in number.

What are the names of all the severall parts of a Peece

The

The Chamber of the Peece, begins at the Touch-hole and extendeth it self towards the mouth, the length of 4 Calibers, whereof 2 are for the place of the powder, and the other two for the shot and wads, from the end of these 4 Calibers, the Peece most commonly hath a girdle or band elevated above the other mettal of the Peece called the moulders or Frises, which is to strengthen the Peece to indure the force of the first straining of the Powder, and to give some agreeable to the Peece; the girdle at the munions ought to be in the just middle of the Peece, and from the Touch-hole to that place, the Peece doth lessen a fourth part of a Caliber; and from thence towards the Chamber are placed the Dolphins, by which the Peece is fastened with ropes to be Mounted, or dismounted, the knobs of the mettal at each side of the Peece are called the Tronions or Munions, and the Chases in the Carriage serving to receive the same, are called Lumes or Troinion wayes, and from this girdle or middle, the Peece doth lessen a fourth part of a Caliber from thence to the mouth in such sort, that from the Base-Ring to the mouth, the Peece doth lessen half a Caliber, the thicknesse of the mettal, as well at the Breech, Tronions, and Mouth is called the reseet; and when the Founder will cast a Peece to make it equall to the bore in all places; he hath 3 crosses of Iron of a finger thick, and placeth one at the Breech, the other at the Tronions, and the third at the neck of the Peece; to keep his Spindle or Munion equall in the middle of the Peece: The covering at the Touch-hole is called the Bragues, the highest Frise at the mouth is called the Ioy, and those at the Breech is called the Rasinire or Base-Ring: And if there be a question of the levell or pointry, the Gunner shall take his sight by the middle of the Rasinier, and the highest Frise at the joy, and that which is the difference between these two is called the Vise or dispart, a thing to be well noted and considered of every Gunner to be used when he shall have occasion to dismount or impeach any Ordnance of the Enemies.

He that is not skilfull in the parts of his Peece not worthy of a Gunners place.

Lieut. This curiosity doth give me great content, and I think him not worthy of a Gunners place, that is not skilfull in the knowledge of the parts of his Peece; now let us proceed, and let me know the names of those things that belong to the Carriage of the Peece.

Gun.

Gun. For thoſe particuler things I intend, I find that there be 18; as firſt, this hath the name of a Cart or Carriage, compoſed of two Jaunes or Cheekes, long, thick and broad, made of hard and ſtrong Wood; as Oake or Nut-tree, the parts before which, is the head of the Carriage, is called the Teſte, the crookedneſſe in the middle is called the Couch or Bed the pieces going croſſe, holding the Carriage together, are called the Falcages or Tranſums, the Iron that goeth thorow the ſaid Faleages, are called by the name of Bervons or bolts, the hole in the tayle of the Tranſum of the Carriage to faſten the Bolts of the Avantrine or Limmers to draw the Peece into the field, is called the Politrine or Furalon, the lyning of Iron in the ſaid hole or Politrine, is called the Floriton, or Chapiton, and on that is a Ring of Iron that compaſſeth all the Garniture of the ſaid Tranſum; the Garnitures both above and below are called the plates, the Plates covering the Tronions, are called the Capſquires, the Plates at the head of the Carriage are called head Plates; the Iron that holds the Extre, are called Extre-Plates, the hookes at the head of the Carriage are called Ganches or draft-hookes.

The names of thoſe things belonging to the Carriage of a Peece 18 in number.

Lieut. This pleaſeth me well, now let us paſſe to the Extree and Wheeles, and ſo to other things?

Gun. I find alſo two members and their divers names, and the Extre is the name of the whole; the Wheeles; the Naves, the Spokes, the Vellowes or Rings; and divers other things both of Wood and Iron, which if I ſhould name them all, I feare would prove tedious and troubleſome unto you; therefore, this not being very materiall, may it pleaſe you to paſſe to ſome other thing, for theſe things are commonly known.

The Extre and Wheeles.

Lieut. Becauſe I would ſatisfie the command of my Lord Generall; I deſire to underſtand with what Inſtruments a good Gunner ought to be provided?

Gun. The Inſtruments belonging to a Gunner are eight in number, the firſt is the Caliper Compaſſes, then the Rule with his numbers; in which is marked the pound weights of all Balls of Iron, of Lead, or of Stone; from one pound to a hundred: And alſo the parts of a Geometricall foot, whereby may be meaſured all Balls and all Peeces, of whatſoever ſort, to the end the

What Instruments a Gunner should have.

Gunner may give to each sort of Peece his due proportion of powder, and find out the Balls to fit the same; also he must have his priming Irons of all sorts. *viz.* Some sharp poynted to pierce other, and other like a wimble to bore, a third like a screue, a fourth like a little hooke to take the thicknesse of the mettal in the Chamber, the fifth round with a point to pierce a Cartridge.

Also he must have a payre or two of straight poynted Compasses to take the height of his Peeces at the mouth, and to divide lines as occasion shall serue; and also he must have a payre of Caliper Compasses, to measure the thicknesse of the mettal of his Peeces, as to take the height of his shot, that he may give his Peeces their due proportion.

Lieut. It is a great ease when a Gunner do well understand the measure of his Peeces.

Gun. Yea Sir, and this may be done three manner of wayes, first, by the crooked Compasses and the Rule; Secondly with packthred to take the Circumference at the Breech, Muniment, and Neck; the third, is onely by taking the thicknesse of the mettal in the Chamber, with a crooked pryming Iron, and these Instruments are determined according to his eights.

Lieut. All things that hath been hitherto spoken are to good purpose now good Mr. Gunner tell me what is more required of a Gunner to have, that he may be intire and want nothing for his profession?

Gun. First, he is to have an Instrument called a Search to try his Peeces, and to cleare them, if any wood, or any such thing remain in his Peeces, secondly, a good large Quadrant with a thred & a Plummet to level his Plat-forms, and to order the same as need shall require; and also a rule of ten or twelve foot long, serving to the same purpose. Also a Quadrant to Mount his Peeces to the just height or elevation, and this Quadrant to be divided into 9 or 12 points, containing in all 90 degrees, and also the Instrument called the Cartabon, to the same effect, as also to take the Meridian and Horizon, and the distance of a place when we come to Batteries or Fortifications, or to know the sure distance of the Carriage of the Peeces; also he must have a Fyle or two, and a payre of pinsors to pull out nayles or the like, also a hammer of

Iron

Iron, and a mallet of Wood, a payre of great Plate-sheeres to cut the Plate for the Ladles, and also a payre of other sheeres to cut out the Canvas for the Cartriges, and fire-workes, also Wimbles or borers of divers sorts both small and great, a hand Beetle, and a hatchet, a Saw and other such like Instruments to use when a Carpenter cannot be had, also short Lintstocks to give fire, well armed with good March, a pryming horn or two with fine powder to prime the Peeces; and also alwayes to have about him a Steele to strike fire to kindle the Matches upon all occasions: Also a Semeter or short Sword, as well for ornament as for the defence of his own person, likewise a great Axe for service at Batteries, and also when the Troopes shall march, these and divers other things do belong to a Mr. Gunner.

Other Instruments belonging to a Gunner that would be intire.

Lieut. You have well answered hitherto in all those things which have been demanded, and have given good and true reasons of those things that depend upon the Artillery; and therefore I will question you no further in this matter, and I wish every Gunner that will take upon him this charge, to apply his mind to this Laudable and worthy Profession, and for my part, I will do my best to countenance you in your affaires alwayes and in any thing afford you my favour.

The Lieutenants admonition and his farewell.

FINIS.

DIEGO UFANO.

The Second Part, in which is contayned a long Conference between a new Generall of the ARTILLERY, and an Experienced Captain, with divers things belonging to the Trayne of the ARTILLERY, in manner of a *Dialogue*.

DIALOGVE. I.

Generall.

CAptaine, the chief cause that made me come to sojourne in this place; is to behold the fayre beauty thereof: and chiefly the great fame and report of the great strength of the Castle, and the divers Peeces of great Ordnance; this place being of great renown: and now let us call to mind what persons or men of account which are or have been experienced in the affaires, and I desire your instruction, especially in the Office and duty of the Generall of the Artillery, as well in time of Peace as Warres; and also a descrip-

tion of all other charges that depend upon the same.

Cap. Most worthy Sir, I am desirous to satisfie you in this your request, as much as lyeth in my power, with all diligence in those things which I have seen by Experience, and that do depend upon the Artillery belonging to the Honourable use of a Camp: And for the more ease and facility in this matter, I desire you to let me understand what travels and what charge you have already undertaken in the Warres.

Gen. I have served certain yeeres in the Warres of our Mr. the King of *Spain*, in *Italy*, there being Captain of a Band of footmen, then I went to *Piemonte* also with certain Lances, and from thence to *Hungaria* with a Band of *Italians*, in the Imperiall service, and served there till there was a Peace; And I appeale and pronounce to all men, the King my Master hath maintained and rewarded me well for my service, in his Honourable Army; wherein I have performed my charge: And because I am desirous to undergo the charge of the Generall of the Artillery, I pray you to let me have your instruction and direction herein, whereunto I will bend all my endeavours.

Cap. Most worthy Sir, I will willingly perform your request, and if you will give eare to my directions, I will instruct you profitably herein; and though I want Eloquence, yet I will recompence the same with my diligence in this behalf; and therefore I will visite you at your Lodging every day, and shew from point to point all things that I have learned in this Hon. faculty concerning the Artillery and the office belonging to the same.

Gen. I thank you heartily, and I will recompence your pains for the love you beare me, in the mean time let us passe to some honest recreations, untill we meet to talk of this matter.

DIAL. II.

The first question of the Office and quality of the Generall of the Artillery.

Generall.

YOu are very welcome worthy Captain, now we are so well met this fayre morning, I hope it will be a good time for us to discourse of our matter.

Cap.

Cap. God give you a good morrow noble Sir, the ſervice that you will inploy me in, I will willingly perform this morning.

Gen. Well therefore to come to our deſigne, I would know and underſtand what is the charge and Office of the Generall of the Artillery, and how he may maintain his Office and charge in his place.

Cap. Moſt worthy Sir, I will diſcover unto you all thoſe things that appertain to the ſtate of the Warres in theſe times, which I my ſelf, partly have had in charge, and have been imployed in the ſame of a long time; therefore underſtand, that this is a place, not onely profitable, but alſo of great weight and importance, whereby he may be preferred unto other Offices, even to the chief Generall or Maſter of the Camp, but he muſt firſt paſſe by theſe degrees, that is to ſay, in theſe eſtates it is alwayes obſerved this order, that he which deſires to be chief of the Horſemen, or Mr. of the Camp, he muſt paſſe by theſe degrees aforeſaid, and then come to be ioyned to this charge of the Artillery, which I will declare in order unto you.

Firſt, you muſt know and make account for all the proviſions, for or belonging to the Artillery; As all ſorts of Armes, as wel Muſkets, Harquebuſes, Powder, Shot and all manner of proviſion and preparation even to the Pyoneer, as Carts, Fill-horſes, Horſes, with Carters to guide them; and many other ſuch things. Secondly, he ought for the better advancement and proſperity of the Army by the meanes of the Artillery, to be skilfull not only in this, but alſo in the knowledge and uſe of all manner of Engines depending or belonging to the Ordnance, that there be no fault found in his skill or experience in the ſame; And he ought to be of an excellent ſpirit, and of a ſubtle wit and good underſtanding, that he may as well maintain his defences, as offend the Enemy.

Gen. Of truth in my mind this is a moſt honourable charge and of great importance, for which cauſe I am deſirous to apply my mind to the ſame, and I hope by Gods help mine own induſtry, and your adviſe and direction, to behave my ſelf as a valiant and worthy Souldier, without ſcruple or feare, and to purchaſe honour reputation and good reſpect.

Cap. It is a certain thing, that this is not only a ſpeciall thing to be obſerved, but alſo as I ſhall ſhew you again, of the underſtanding

ding that a man ſhould have of the Camp when it doth March, for the plotting of any enterpriſe, and alſo when it doth lodge in any place, the Generall of the Artillery hath alwayes a part of the charge, and when the chief Generall is abſent he is to command all the Army, and this I have ſeen and known to be the practiſe and uſe of Count *Charles de Mansfelt*, of *Monſieur La Mot*, of Count *de Baſſus*, of Count *de Barat*, of *Don Lewes de Valaſco*, and of Count *de Bucquoy*, Generals; in their preſent ſervices, and it is moſt certain that a man cannot be admitted to a more high charge except hee paſſe theſe with a good ſpirit, and a ſound judgement in the ſervice of all theſe occurrents.

Gen. Noble Captain this doth wonderfully pleaſe me to ſee that ſuch excellent perſonages of ſo great Fame and account in the world, have ſo imployed themſelves, and alſo I hope by the help of God, and favour of his Majeſty, ſhortly to obtain: in the meane time, I pray give me more cleere and further inſtructions of all other things upon which this Office dependeth.

Cap. Sir I will willingly perform your requeſt, and firſt I will declare unto you thoſe things that I propounded to you in the firſt order.

Gen. Let us now go to dinner, and after we will ſearch out the courſe that we muſt take to pitch or place a Camp.

DIAL. III.

Of the Proviſions for an Army with 30 Peeces of Artillery.

Generall.

NOw let us begin to ſet forth a Draught of the Proviſions for an Army of 40000 men. *viz.* 34000 foot, 6000 horſe, and according thereto 30 Peeces of Artillery.

Cap. Sir in my opinion, I do ſurely think that 30 Peeces are ſufficient to march againſt any Enemy, be he never ſo ſtrong, or to gain or to winne any Fort, be it never ſo expugnable; but firſt and formoſt, before you ſhall begin to march, we ought to enter into councell of the Warres, and informe our ſelves of the pleaſure and Command of the Prince or chiefe Generall accompanied with Officers

ſeers of eſtate, that is to ſay, the Purviour, the Treaſurer, the Pay-Maſter, the Maſter of the hoſtile Camp, to weigh and examine with great diligence, all thoſe things that are requiſite and fit for ſo great an enterpriſe, ſhowing what proviſion ought to be made for the Artillery, as Powder ſhot and other neceſſary proviſions and Munition, of which they ought to make a note or Bill and preſent it to the chief Generall, which for the advancement of the ſaid Officers may give order for ſo much Mony, requiſite for evrey kind of Proviſion, that there be no default made for want thereof, and then diſpatch Officers or fit Commiſſaries for the ſame, the one to provide Armes, the other to make proviſion of Powder and Shot, the other to levy and provide Carts and Carriages, and Carters for the ſame, ſo many as need requireth, making agreement with the Carters for their meanes or pay, that they ſhall have or receive, and how much for every Carriage accompanied with 3 horſes, and then preſently after they be bound or preſt, to give them ſo much Mony in part as ſhall be fit to provide ſuch neceſſaries, that in ſuch a buſineſſe there be no default in their charge; And theſe Commiſſaries or Officers ought to be men of honour, honeſty and great credit, the Generall of the Army ought to be bound to take good and fit order for the aſſurance of each mans pay.

After he ſhall appoint a place where all the Gunners ſhall draw to a head, or reſort, and that all the Peeces be viewed and ſearched by good and exact Gunners, which ought to be accompanied with a convenient company of Gentlemen of the Artillery.

Cap. Indeed this is a goodly order that is to be obſerved in the quarters. But now let us paſſe it if you pleaſe, to the information of theſe things, and of the uſe and application of the Artillery, for it ſeemeth to me there ought to be a principall overſeer in ſo great an Army of 30 Peeces of Artillery.

Cap. Thrice worthy *Senior*, for the greatneſſe that theſe Peeces will be in one battalian, they ought not to be placed together, but upon certain Angles, and not in the Front becauſe of ſmoake, which will cauſe a great inconvenience, and trouble to the Gunners, and this many times falls out in many ſtratagems and ſuddain encounters of the Enemy, which one would not think, and for the ſcituation of the place, and of what force and ſtrength, and how it may be guarded, theſe 30 Peeces will be ſufficient; becauſe we may

contract or draw them into two batteries generall, and those into 3 Camrads, and these into 6 Defences, that there shall be no need to charge the Army with so great and troublesome a Trayn, as also for the great number of Carriages superfluous, which will require great store of forrage and horse-meat, which a prudent overseeer must be carefull of.

Gen. I have often times heard it debated among Souldiers of good experience, and good reasons alleadged, that to march with an Army in due proportion, who ought to allow for every thousand men one Peece of Artillery, and thus for forty thousand men we ought to have forty Peeces of Artillery in the Army.

Cap. It is true there hath been such dispute or question, but I am well assured that *V. S.* doth use no set rule or order precise, and I can say something in this matter, that I have sometimes seen the number of men to exceed the Artillery, and sometimes the Artillery to exceed the number of men, so that there is no set rule or order for these things, but as occasion may be thought fit in time of necessity.

Gen. Suppose then that we be content with 30 Peeces, what are the Peeces of Artillery most needfull for an Army?

Cap. The most proper Peeces for an Army are the Cannons for battery, the Demi-Cannons, whole Culverings, Demi-Culverings, Sakers; and what Peeces soever may be thought convenient for such occurrents, as well for the Field as for a Siege, and of every of these sorts they ought to be devided and ordered in this manner, that is to say, 9 Cannons, 8 Demi-Cannons, 6 quarter Cannons, and 7 Peeces of the Field, the Cannons may serve to the Siege of any place, or at any other assault as occasion may serve: and moreover great care must be had that there may be no want of Balls or shot for every such Peece.

Gen. What is the reason of this care of shot?

Cap. Because the Peeces of the Enemy may be greater then our Peeces, and then the shot that will serve them will not serve us.

Gen. I think that so forcible an Army cannot be so without reason, or so careless, but to have sufficient for all sorts of shot.

Cap. There falleth out many times in skirmishes and other occasions, that for the present there may want both Powder and shot as I have seen by experience the same event, to fall out even in good

good experimented Generalls, that have been diligent in theſe affaires, and carefull in their proviſions; And this was the cauſe that the Emperour *Charles*, in the Warres that he made againſt the Kings of *France*, commanded his Generall and the Founders of his Ordnance, to make the Caliber of his Peeces greater then the Enemies, to the end that he may ſerve with their ſhot, but not they with his; by which meanes, in ſhort time the *French* wanted ſhot, and the Emperour had great ſtore.

Gen. This was a Stratagem of ſingular prudence, and the iſſue proved very well; but now let us go forward to ſearch further, about the proviſions for our Army that are moſt neceſſary.

Cap. Neceſſity requireth how alſo on our part we ſhall behave our ſelves, to march with our Army and to make proviſion of all ſorts of Munition needfull for the ſame, and to diſtribute the ſame into 2 or 3 Magazins, or Store-houſes, which are moſt comodious and moſt neere to the way that the Army ſhall march or paſſe.

Gen. Wherefore ſhould we chooſe ſo many places, ſeeing that one place may be ſufficient for this buſineſſe and more fit then if it were diſpierced into divers places which I hold neither fit nor convenient?

Cap. Sir how can this be, it ſhall be alwayes my adviſe to part the ſame for divers reaſons, for the danger of keeping the ſtores all in one place, is great and ſubject to many inconveniences; for if one place be ſurpriſed all is loſt, whereas, if it be in divers places, the one may be ſafe though the other fayle; which not long ſince we had an example of a Thunder-bolt that fell at *Naples* in the faire Caſtle of the *Santalme*, wherein was kept all the Powder, and alſo an other time in *Lombardy*, and at *Lingen* in *Friezland*, and theſe examples may ſerve us to underſtand the danger of keeping the ſtore all in one place, as alſo that which fell out in *France*, in the Warres of *Henry* of *Burbon*, againſt the States, for he making his Magazine of all his Munition in the Town of *Amiens*, a place as he thought very commodious for the ſame effect, which we having knowledge thereof; then we by a certain Stratagem, and the valour of certain of our brave Souldiers, the King loſt the Town and all his Munitions and proviſions that he had formerly made, to his great loſſe and impoveriſhment.

Gen. I pray you let me underſtand how this was carried and came to paſſe.

Cap. His highneſſe being advertiſed by the Governours of *Artois* and *Hinningan*, that the King would make his Arſenall for the Warres in the Town of *Amiens*, and alſo that he had left but a few Souldiers in the Town to guard the ſame, and the Burgers were careleſſe of the Warres and made little reckoning of guarding their Ports. Gave Commandment to the Governour of *Dorlian Harma Rollo*, and to the guide of the way, and alſo to his Gariſons againſt the ſaid Town, to make their ambuſhments in a Cloyſter about a mile from *Amiens*, and in a Morning certain Souldiers being diſguiſed like Clownes, and alſo a Wagon with Hay, under which were placed certain Souldiers, then all things being placed in order, he that carryed the Bag of Wall-Nuts came to the Gate, and after he had entred the Port, the Waggon of Hay was come, and made a ſtand under the Portcullice, the Clownes playing or toying one with an other, tumbled down the Nuts in the ſtreet, the *Corps Du guard* ſeeing the ſame came to ſcramble for the Nuts, then the Souldiers came out of the Hay and ſlew all the Garriſon, and our Ambuſhments came and took the Town and all the Kings proviſion.

Gen. Certainly theſe were brave Souldiers, and worthy of much honour; but now let us come to Plat and lay down what Proviſions will be fit to be uſed in theſe Magazines or ſtore-houſes that are moſt fit to be uſed about the Artillery.

Cap. A project or Draught of all ſuch ſorts of Munitions which ought to be provided, and alwayes had in a readineſſe in Magazines that they may ſerve upon any preſent occaſion when an Army ſhall march, that nothing be wanting in the Artillery.

Shot.	
For Cannon	5000
For Demi-Cannon	12000
For Culvering	14000
For Demi-Culvering	16000
Of Powder, ſmall barrels	4000
Match	5000 hundred
Lead	2000 hundred
Muskets	2000
Hargubuſes	2000
Curats as well ſingle as double and all other Morians thereto belonging	2700
Piſtols and Carbines for the Horſ-men	1500
Lances	500
Neceſſaries for the Pyoneers and others.	
Shod ſhovels and Spades	6000
Matocks	4000
Sledges	1000
Small Hatchets and Bills	1000

Axes

Axes 1000
Small Baskets to carry earth, 1000
Sacks of Canvasse for the like 2600

Carriages.

Carts for one Horse, 100
Saddles and other things belonging to the Carts 500
Cordage of all sorts, 1000 hun.
Nayles and Spikes of all sorts, 1000 hundred.
Artificiall Bridges and Carts, as need requireth.
Certain barrels of Pitch, Rosin, Brimstone, Tow, and Ocam, and all other things for Fire-workes.
Cressets and Cresselites 5000
Lanthornes, 100
Candles, 22000.l.
A good quantity of Tand-hides, Calves-skinnes and sheep-skinnes, to cover the powder.

For the Artillery

Spare Carriages for Cannon 3
Spare Carriages for Demi-Cannon 6
For Culvering 4
For Demi-Culvering 4
For Saker 8
Long Waggons for Carriage 8
Avantrins to repose the tayle of the Carriage of the Artillery 18

Item. A good quantity of spare Wheeles, as well for Cannon as all other sorts of Peeces, and Extrees, and Limmers and other things belonging to the Ordnance, and their Carriages.

Ginnes, with Ginne-Ropes and other things thereto belonging, 8

Racks or Martinets 4
Hand-Ropes 6
One Carbisant, 1
Deale boards, a great quantity,

A good provision for Axes, Hatchets, Sledges, Sawes, and those things that must be used upon a suddain.

Melting Ladles great and small.

Moulds to cast all maner of small shot.

Item. Two great Morter-Peeces of Brasse, to shoot Granadoes Fire-workes, and stone shot.

Ladles, Spunges, Rammer-Heads, Levers, a good number.

Gen. Certainly these things are very fit to have in a readinesse upon all occasions of the Warres, and ought to be especially regarded, even to a very small thing that a Generall ought to provide in the case of necessity to set forth the 30 Peeces of Ordnance, belonging to the Army whereof he hath the charge.

Cap. According to these Provisions, if the journey be long we ought to make our Provisions thereafter; of the said Munitions, as also a competent number of Carts or Waggons, and Draught horses, of which we cannot make any certain account, just in those things that belong to every part, and therefore in my judgment, we ought to take the Councell and know the mind of the chief Generall of the enterprise and of his Councell of Warre; how we may make provision but onely for 15 dayes, alwayes provided that we follow the course aforesaid to provide the things.

As for Example, the weight that may be found in these things for 30 Peeces, that is to say,

For 9 ---- Cannons.
For 8 Demi-Cannons.
For 6 whole Culverings.
For 7 Sakers or Field Peeces.

And during the said 15 dayes we make account for the Cannons 8 shot a day, and so the Demi-Cannons 10, and for the Culvering 12, for the Demi-Culvering and Saker 14 shot a day, and that we are to Batter a Town or Castle or any other place, to hinder the force of the Enemy, or to impeach their reparations, we ought in the beginning to account for 4 dayes, 32 shot for every Cannon, and after the proportion aforesaid, to provide for the other Peeces; and these provisions ought to be provided and had in readinesse in the next Magazines neerest to the designe, which provisions by my advice is enough for the first addresse or beginning of the enterprise, untill the time that other Provisions may be had, and this for sparing the paynes and charge that many times falls out for want of men and Money, or that the Prince or chief of the enterprise is not very Rich, or strong, and that the thing may be carryed on without suspition. I esteem it more convenient, that the beginning be somwhat lessened, or lesse then the whole intire charge, as well of Munition as Victuals for 6 months, which is the longest time that men may abide in the Field, chiefly in these cold

cold Countries; and beginning about the firſt of *May*, we ſhall ſcarce March for lack of forrage and other neceſſaries, and to ſtay in the Field till *October*, will alſo be much, by reaſon of cold and much raine and moyſture.

But to returne to our purpoſe of the proviſion of 15 dayes for 8 ſhot a day for every Cannon, for 15 dayes, amounteth to 120 ſhot for one Cannon, and for 9 Cannons after that rate, amounteth to 1080, and of fine Powder according to 20.l. a ſhot for a Cannon, for thoſe 15 dayes cometh to 21600.l. that is 27 ſmall barrels, at a 100.l. to a barrel, and for 10 ſhot for every demi-Cannon amounteth to 150 ſhot or balls, and for 8 of theſe Peeces 1200, and this ſhot weigheth 28800 for 14 ſhot, for every ſhot of a Saker 210 bals and theſe uſed 7 times, is 1470, which will weigh 8350.l. for the powder, according to the rate of 20 l. a ſhot for a Cannon, 12.l. a Culvering, Demi-Culvering 6.l. Saker 5.l. we ought for the ſaid time of 15 dayes, to allow 49830.l. beſide that which muſt be allowed for Muskets and other ſmall ſhot, and the Mines which ought to be 40000.l. notwithſtanding in point of Combat or skirmiſh, there ought to be a further allowance according as ſhall be thought fit upon ſuch occaſion, on the other ſide, for feare of being ſet upon by meanes of ſome expedition practiced by the Enemy, many skirmiſhes falleth out, we ought to make more allowance of all the Munition for certain dayes, leſt wee be overthrown in the Field.

For the ſaid Muskets, and ſmall ſhot, we ought to provide 600. hundred, which amounteth to 60000 weight, and Lead ſhot for Muskets 40000.l. weight.

Item. 500 Muskets packed up in Mats, weigh	1500.l.
Hargubuſes 400 likewiſe packed up weyeth	4200.l.
Pikes fifteen hundred, weighing	9000.l.
Piſtolls two hundred, weighing	2600.l.
Lances three hundred, weighing	1500.l.
Mattocks a thouſand, weighing	5000.l.
Spades three hundred, weighing	1500.l.
Axes or Hatchets one hundred, weighing	500.l.
Hand Bills and ſmall Hatchets a thouſand, weighing	4100.l.
Baskets to cary earth three hundred, weighing	1200.l.
Sacks or bags of Sack-cloth to carry earth 1600, weighing	1200.l.

Shod

Shod shovels twenty five hundred, weighing 1200l.
Ladders twelve, weighing 300.l.
The weight of all these amounteth to 35680 pound.

Which will require 295 Carriages or Waggons, accounting 1200 to a Carriage.

Moreover for 200 Saddles or Cushions for the Waggoners, and 600 payres of Stirrops, 200 payre of Cords or traces for horse harnesse, 100 hundred of spikes Nayles, and hookes of Iron, or Ankers, hand-ropes, Gynnes, barrils of pitch and Tarre, Candles grease, and other things necessarie, these all will require 16 Carriages; then for the Carriage of the Tents 5 Carriages, and for the rest of the stuffe or baggage 50 Carriages, the whole summe of Carriages amounteth to 356.

Gen. This order of Trayn and provision doth give me great content, but good Captain tell me now, we making provision for 15 dayes, what if we should be constrayned to shoot continually, why do you count so few shot and powder, if there falls out any suddain skirmishes, or that we should hastily or unlooked for, Besiege or force any Town or Castle, we ought to allow more advantage in Munition, and if we shall presently with all our force order our Battery and be sure to beat a breach, how should we devide all this provision that the one doth not hinder or choak the other.

Cap. There is good remedy for these things, if such a place as you will Batter from morning to night, and that you make a doubt whether they will render or no, you shall then make your account for every Cannon 120 shot, for every Demi-Cannon 150, and for every quarter Demi-Cannon 180, and for every quarter Demi-Culvering 210 for the foresaid 15 dayes, and if it fall out that you shoot continually it will not continue above 2 dayes upon that occasion: and it may be you make 12 shot in one peece, in another 20, in some more, in some lesse as occasion shall serve, it will not be above two dayes, and suppose there fall out a most furious battail it will not continue above 3 dayes, scarce that, & suppose there be occasion to shoot continually, as it fell out in the journey of the Emperour *Charles* the 5 in his designe of *Ratisborne*, against the Duke of *Saxony* and the *Landtgrave* of *Hesse*, in the which on both sides were shot three thousand shot, and not only that, but also one eighth part more, that is 4850 shot, and the Enemy on his

part

part as many, for which cause one ought to have great regard that our Peeces be of a greater Caliber then the Enemies, because we may serve with their shot but not they with ours.

Moreover how much powder may be used upon such occasions, ought to be well considered that there be no dammage, and a more liberall allowance to be given in case we are to shoot continually for 15 dayes, we ought to allow more then 1000 hundred or 1000 barrells, and this is alwayes to be considered by the chief Generall or his Councell of Warre.

Gen. Now what order is to be observed for default of those things that appertain to the Carriages, if they should fall to default.

Cap. It many times falls out, the wayes that are made for the Warres are much hindred by meanes of the hils & crags, for which cause, one ought to have great discretion and great skill and regard in making Provision for the Ordnance in such sort, that for 3 Cannons or other Peeces mounted upon their Carriages, we ought alwayes to have 10 spare Carriages in a readinesse to use upon any necessary occasion, and that all those Carriages, as well Cannons as other to be well made, strong and sufficient, that there be no defect in them, and this that I have said concerning the said Ordnance, is to be understood in Planes, or certain Rivers or waters, when we are Commanded to passe by the same; which giveth commodity of Carriage by boat, as planks, Deale-bords, and other things necessary, with small payn in carriage and transporing them into the Field, and these may serve with lesse charge then when in the beginning we made this provision by Land.

Gen. I would understand also what is to be done when there is no Rivers or waters?

Cap. Then *V. S.* took great pleasure during the time of his presence to understand by noting the Frontiers in *France* and those places that were destitute of water, and also the Navigable Rivers, to ease the charge and paynes of the carriage.

DIAL. IV.

A note of the Provisions and necessaries, as Horse Harnesse, all manner of draughts and other things belonging to 30 Peeces of Ordnance.

Cap. FOr 9 Cannons, 8 Demi-Cannons, 6 quarters, and 7 Field-peeces, for to supply all defaults, that may happen in the

way of the buſineſſe of the Warres, make this proviſion following.

For 9 Cannons, 3 ſpare Carriages, for 8 Demi-Cannons, and for the 6 Quarters, and the 7 Field Peeces, 2 ſpare Carriages, for every ſort, and alſo 5 Carts at the leaſt, and all Crowes of Iron, Levers, hand-ſpikes, and other things.

Item. twenty Wheeles for the ſaid Carriages, 8 great and 8 leſſe for the long Waggons, 12 Limmers, ten Extrees of all ſorts, and alſo proviſion for Iron work, as Spikes, Nayles, Wores, and the like.

And according as the buſineſſe is in the journey, to appoint more according to the diſcretion of the wiſe and underſtanding Generall, who being carefull of his Honour will omit no fault in his enterpriſe, but chiefly to be carefull in the materiall for the carriage of the Artillery, as well to avoid too much, as to want proviſion, conſidering that every ſmall fault may endanger a whole Army, and the meanes of doing right may quit himſelf of all occaſions of errour.

Gen. In truth theſe things are to be carryed wiſely and carefully and it is a great matter, to fit and adviſe things fit for all theſe Peeces, chiefly in places or wayes that are Rocky and full of hills, the Waggons being long, and ſo the Peece will lye looſe and jogging; and therefore I hold it beſt to mount the Peeces in their Carriages, which will be more ready upon all ſuddain approaches of the Enemy, and more ready to be uſed.

Cap. It was long before *V.S.* could conſider ſufficiently the profit of theſe Waggons for the removing or tranſporting of the Artillery, which Waggons are not only more fit for this affaire, but alſo farre more profitable for other Occurrents, as to carry Bridges, Boates, and other things of great charge; as if there were occaſion to carry or make a Bridge of great trees in haſt or bruſhy wood, the more great Trees may be carryed or tranſported in ſuch Waggons, I am well aſſured more fit and eaſily, and there cannot be a more excellent Engine or invention proper or more fit for the Artillery then that is.

Moreover it falls out in places ordinarily in places that are plain the Enemy ſhall incompaſſe the Camp to endammage the ſame, theſe Waggons with the other that are ſmaller, one among another may make ſuddainly an intrenchment or Barracadoe in that

place

place to keep the Enemy, and eſpecially the horſmen, from doing any ſuddain enterpriſe; Moreover conſider that a great Peece of Ordnance ſhall be carryed more eaſier in ſuch a Waggon, becauſe the Wheeles are more fit and able, chiefly if we muſt paſſe in foule wayes, durty or ſandy; And conſidering that a Cannon ſo carryed ſhall not weigh above 7544.l. for the which we ſhall not need above 23 horſes, that is for every horſe 328.l. now this Cannon upon her Carriage ſhall weigh 8600.l. wch. will alſo require 23 horſes, but then every horſe muſt have 374.l. that is 45.l. a piece more, and this is worthy to be conſidered, that when we meet with ruffe and Rocky, foule and Sandy wayes, theſe heavy Peeces may more eaſily be tranſported, by reaſon the Waggon wheeles are more fit for ſuch a purpoſe then the Cannon wheeles that are low and broad and cannot ſo eaſily be drawne.

And for as much as in the ſuddain approach of the Enemy, the Cannon mounted upon his Carriage is more fit and ready for uſe; yet the Field-Peeces which are light and more ready for ſervice, may ſupply any want in that behalf, for if we march wiſely, it will be a hard matter to be put to that extremity, but that we may mount our Ordnance, having Ginnes and men ſufficient, and to place them in their Angles and ſquadrons, as we ſhall ſee good; for if we march in good order, having alwayes the ayde of the Footmen and Horſe, we may ſafely encounter the Enemy.

And if he make his approaches on any ſide, as ſeldome times it ſo falleth out; thoſe that are in the middle or Reere-gard will be ſufficient to cover the Ordnance, in ſuch ſort, that the ſmaller Field Peeces being alwayes in a readineſſe to prevent their deſigne till the other great Ordnance ſhall be fitted accordingly, as time and occaſion ſhall ſerve.

And alſo this is to be conſidered that the Cannon is not ſo uſefull except it be charged with ſmall ſhot, as Burs, Spikes, Muſket ſhot or the like; and then theſe will work more effect then the Field-Peeces will doe, and I aſſure my ſelf that *V. S.* did alwayes reſerve the Cannon for Battery to overthrow Walls and Forts, and reſerved the ſmall Peeces for better uſes.

Gen. This is a faire diſcourſe and order, proper and convenient for thoſe neceſſary things, and this experience that you have gained in the fore-paſſed warres doth give me ſingular content, and

chiefly the use and commodity of the Waggons, which I must now confesse is most fit for the conduct for the Trayn of the Artillery.

Gen. I hold it good to have regard that the Carpenters make no default of their materials for the Artillery. *viz* Limmers, wheeles, Extrees, Carriages, and all other things to use about the Ordnance when need is.

Cap. This is true, and also that choyce be made of good wood strong and durable, and cut and felled in their season, alwayes as necessity shall require in that place, and that no more be provided then shall serve ỹ turn, or to serve 2 or 3 dayes, & that they be carefull that they make no default in this so weighty & special a busines.

Gen. Certainly this is a very good course for the harnessing and fitting of the materials for the Artillery, now I pray you tell me what wood is most proper for this businesse.

Cap. These things ought to be of good wood, strong and hard, as Olives, Chesse-nut-trees, Wall-nut-trees, or Oakes, or the like; although in *Spain*, especially at *Mallago*, they make the most part of Poplers, brought from *Rome*, which are very great; and are growing by the River of *Chenell*, and brought thither by Waggons for this purpose.

DIAL. V.

Now we will speak of the weight of Armes, and the distribution of them into the Waggons or Carriages.

Gen. NOw concerning the Armes, and the distribution thereof; I pray you tell me how much the Musket and other Armes do weigh.

Cap. The Musket with the appurtenances, as flasks or Bandileers, and Rests and such like, may weigh about 15. l. the Caliver 10. l. a Pike 6. l. the Shovels, Spades, and the Hatchets, or Bills, may weigh one with another about 5. l. and the Crook Bill or Hook about 4 pound.

Gen. And ought we now for these things to provide 267 Waggons?

Cap. Yes, and over and above we must provide for those things that belong to the baggage, chiefly belonging to the service of the Artillery.

Gen.

Gen. How ought we to provide and fit both for the harneſſing and fitting the Carriages and horſes for the Trayn of the Artillery?

Cap. For the Trayn which we now ſuppoſe to be for 30 Peeces of Artillery, we ought neceſſarily to provide 1524 horſes, and 588 Carters or Waggon-drivers, to wait alwayes upon the conduct or guiding of the Artillery, and 986 for the other Carts or Waggons and if there be an occaſion of carriage of Bridges, Boates, and the like, we muſt allow ten more.

Gen. How many horſes muſt we have to draw a Peece?

Cap. For the Cannon we muſt have 23 horſes at leaſt, for the Demi-Cannon 15 or 17 horſes, and for the quarter Demi-Cannon 9 horſes, alwayes provided that if the wayes prove ill or troubleſome, we muſt allow more as then we muſt allow for the Cannon 30 horſes, for the Demi-Cannon 23, and for the quarter 13, now for the Cannon the 7 horſes which ſurmount the number of 23 may be ſpared; for if the Peece be mounted in her Carriage then they may draw the Waggon, and if the Peece be carried in the Waggon then to draw the Carriage; and ſo of the reſt, and thus we ſhall imploy 100 horſes extraordinary.

Gen. I pray you what is the weight of a Demi-Cannon, Carriage and all?

Cap. The bare Peece weigheth 4100 and with the Carriage being well bound and ſhod with Iron, it may weigh 5000 or 50 hundred, and for this we muſt provide 15 horſes, and theſe to go double as they do in Coaches, and this is according to the proportion of 300 ℔ for a horſe, and this is as much as is allowed throughout all *Europe*, but if the wayes prove foule, Rocky and Sandy; then we doe allow 17 horſe to eaſe the payn and travell of the Carters or Waggoners.

Gen. And how many horſes to another Cart or Waggon?

Cap. Three horſes.

Gen. And how much do you allow for the draught of a horſe?

Cap. For one Carriage we allow 1500 beſide the weight of the ſaid Cart or Waggon, which may be ſome 4 hundred, and ſo every horſe drawes foure hundred and a half.

Gen. By this reaſon it is more charge to draw the Ordnance in a Waggon then in her Carriage.

Cap. And good reaſon, for the Waggon Wheeles are more

plyant then the wheeles of the Carriage, and will passe better in foule wayes, and also the harnesse for the horses more short and easie, and the Waggons will passe more light then the other.

Gen. This reason doth content me, now to the rest of the Carriages for the baggage.

Cap. We must also have a care of the other charges of the Army and of the Trayn of the Artillery, that also in this part there be nothing lacking, or any default in levying the Carriages for the other estates and persons, which provision of Carriage ought to be prepared a part from the other account, that is to say,

	Waggons
For the Generall of the Artillery ——	6
For two Lieutenants two a piece	4
For the Treasurer	2
For the Pay-master	2
For the Master of the Camp,	1
For the Commissary or Muster-master	1
For 3 Gentlemen one, which for 15 Gentlemen is	5
For the Carpenters, for the Gynnes and other things	2
For the Provost	1
For the Quarter-master	1
For the Iron works, as Sledges and Hammers	2
For the Master of the Carriages	1
For the Carpenters extraordinary	1
For the Engineers for Fire works	1
For the Jngineers for Forts	1
For the Doctour and Chyrurgions	1
For the Apothecary and his Druggs	1
For the Myners	1
For the Pyoneers	1
For the Matriners and Calkers of Boates	1
For the Tents and Chappell	5
The whole number of all these is ——	41

Now see the account, that is ordinarily made by his Majesty is alwayes restrayned in times of necessity.

Gen. According to this account we ought to Levy 306 Waggons?

Cap. That is as the journey doth require for smoothnesse of the way

way or Navigable Rivers, and ſuch like may require leſſe, and ſo accordingly to allow more or leſſe.

Gen. And moreover we ought to be provided of a Bridge and ſuch like.

Cap. Yes, and alſo of Bords, Planks, Joyſts, Pyles, and many other things for paſſing the Army or the Artillery, as Levers and other things for the foot-men to help about the Artillery, eſpecially if the journey be long, and the affaires great; and thoſe things that we judge moſt convenient for the accompliſhment of the buſineſſe and alſo to call to mind the examples of ſuch expert men as hath been experimented in ſuch affaires, and contrariwiſe, to ſhow ſuch occaſions and faults as have been committed in the like caſe.

Now Noble Generall, ſee here what is required in the great proviſion in the Trayne of the Artillery.

DIAL. VI.

Of the Officers belonging to the Trayn of the Artillery.

Gen. I Underſtand all this that hath been ſpoken concerning the Trayn of the Artillery, but of the Offices and Officers we have not ſpoken, I pray you declare to me in brief the duty and charge of every Officer?

Cap. I will firſt ſhew you the Office of the Generall of the Artillery, and then for his ayde he is to have two Lieutenants, then the Treaſurer, then the Pay-maſter, the maſter of the Camp with his aſſiſtant and Officers, and as neceſſity ſhall require, one Commiſſary of the Muſters, or Muſter-maſter.

Theſe are the principall Officers, and are moſt commonly named or placed by the Prince or chief Generall of the Army; and theſe ought to be not onely honourable men, but men well experienced in the Warres, and alſo with good credit and reputation with all the reſt of the Trayn.

But theſe following are viewed and named by the Generall of the Artillery. *viz.* 15 Gentlemen well experienced in the Artillery, 12 conductors for the Artillery, 4 Conſtables or Mr Gunners, 80 common Gunners, 30 Packbearers or labourers to carry burdens, two Surrers or forgerons to make fire, 2 Marſhals, 4 Carpenters

ters in ordinary and also there labourers and assistants; 50 Myners with their chief Mr. 2 Cartwrights, 2 Coopers, 30 Carpenters, extraordinary, with their Mr. or Superiour, 100 Marriners, chiefly such as use the Rivers or Streames, 2 Engineers of artificiall fire-works, 6 Petarders, 2 Engineers of Fortifications, one Provost with his Lieutenant and Halberdiers; one Mr. Quartiller, one Doctor, 2 Chyrurgions, 2 Barbers, one Apothecary, one or two thousand Pyoneers, as necessity requires; 2 Tender swith their Mr. and 1 Chaplaine. And these are the most necessary Officers that belong to the Army.

Gen. This is enough for this time, now let us return to the duty and charge that is required of every particuler Officer from the Generall to every under Officer, every man in his place.

TRACTATE, II.

Of the duty and charge of these Officers, and first of the Office of the Generall; And how he may carry himselfe to discharge his place with Credit and Reputation.

Cap. WOrthy Sir, may you please to see further into this our intended businesse?

Gen. I am much bound to you for your paynes and kindnesse; Now I pray you declare to me the bound and duty of these Officers in particular, and to the end we should keep good order, let us begin first with the person and charge of the Generall.

Cap. There be many things required in the charge and Office of the Generall of the Artillery, first that he be of a mild and gentle disposition, being long and amiable to all men, and especially to those that are appointed with him in his affaires, and are under his charge, and more especially in the carriage of his businesses in combats and Batteries, shewing himself magnanimous and liberall towards his Gentlemen and Gunners, and rewarding them when they make good and wel placed shot to the mark, and hartning and incouraging them with gentle speeches to do the like at other times; Also he ought to be a great Enemy to Swearers and Blasphemers, to Drunkards, detracters, and all other things that may incurre the displeasure of Almighty God, in whose favour all things

must

muſt proſper, and nothing can come to good without his bleſſing; therefore, the Generall ought to puniſh thoſe things that are committed againſt the Majeſty of God moſt ſeverely: and thoſe that are committed againſt men with leſſe rigour. And that he doth admoniſh and warn all his Commiſſaries of their charge and duty, and that they do no violence to the people of the Country, where they lodge or forrage; and that they be content with their Pay and allowance of Victuals, and not to wrong any perſon, nor to moleſt the Peſants; and thoſe that are found faulty in theſe or ſuch like things, to puniſh them.

Alſo to command the Officers of the Pyoneers to carry a gentle courſe in cutting of Faggots or ſuch like neceſſaries, that they doe not ſpoyle or hurt the Trees that are profitable, as fruit Trees and the like, and that they be diligent to trimme or dreſſe the wayes, when they are imployed from the Camp for that purpoſe, and to ſpare the woods and trees as much as poſſible they can, and thoſe that do make default therein, to be diſcreetly puniſhed.

And if it fall out that there be any hurt or dammage done to the common people by the Souldiers, then to conſtrayn the Captaines, Camp-maſters, and Serjeant-Majors, to make it good; and ſo much the more, as many times it falls out, that the Enemy may come in and joyn friendſhip in conſideration of ſome good quarter to be obſerved and kept by them; ſo that the great ſpoyle and hurt of the Wood, Fruit, Trees, Corne, and other things will prove hurtfull to the Common-wealth; and alſo the Army that ſhall march in that ſeaſon by thoſe wayes may injoy the fruits and commodities thereof, to the great refreſhing themſelves.

Moreover, that he declare to his Lievtenant that thoſe that are under their charge and depend upon the ſervice, as the Gentlemen of the Artillery, the Gunners and other Officers, to be content in their quarters to them ordained without mutiny or grudging, and that the Quartermaſters ordained for that purpoſe, to be careſull that every man be placed to his own content, and that in all theſe things there be not ſo much as any appearance of diſcontent, that the Generall thus carrying himſelf in his command, may be loved, honoured and well eſteemed throughout the Army.

Gen. Beleeve me Sir, theſe things are well worthy the conſideration, as well for the diſcharge of Conſcience, as for faithfull ſervice

vice to the Prince, and the Generall in all right and equity ſhall acquit himſelf with great honour and reputation; moreover, how he ſhall furniſh himſelf with skill and underſtanding of the particular duties of the Generall, and how he ſhall acquit himſelf of all occaſions in the Warres, theſe things I deſire to know?

Cap. Firſt when the Army ſhall march, that he alwayes take heed that his Trayn be well ordered and gathered together, as much as commodiouſly may be, for all the Army doth much depend upon his eaſe and facility, and it is great payn to the Souldiers when they are conſtrayned to march in too large a ſpace.

Gen. Now we have mentioned this thing, I pray you tell me, what order we ought to keep in the marching of the Infanterie; as horſemen, Carriages, Victuals, and the Artillery, and thoſe things that depend upon the ſame.

Cap. Worthy Segnieur, I will give you content in what I may in this thing.

Say then, that our Army of 40000 men ſhall march in Battalia as is required, parted in 3 Troopes, the Artillery and his Trayne parted into two parts, the Van-gard, and the Reere-gard, the ordering of the horſe is by the Office of the Collonel Generall of the horſemen, his Lieutenant or his Commiſſaries; the foot-men, alſo are ranged by the Mr. of the Camp, or Captain Generall of the ſame; but the Artillery and his Trayn under the command of the Generall of the Artillery.

And to the end that you may the better underſtand, I will declare unto you that full experience that I have gayned in the Wars, in what order the Army ſhall march moſt convenient and proper, according to the order now uſed.

Suppoſe the Army doth march, and adviſe be propounded of the taking and ſurpriſing, as well of the Van-gard as of the Reere-gard, then in this caſe, in the former point of the Infantery ſhall march 500 horſe of Warre, parted into one or two Troopes, or as neceſſity ſhall require, and they ſhall diſcover all the dangerous wayes on all ſides, as Woods, and all ſuſpected and dangerous wayes where the Enemy ſhall paſſe.

After theſe horſe, ſhall march 2000 foot-men, as well to cover or defend the Ordnance, as to defend themſelves, alſo parted into one or two ſquadrons, marching in good order, well defended with neceſſary weapons.

After

After theſe ſhall march the Artillery, being 30 Peeces as is aforeſaid; with their Conductor devided as followeth, and alſo one or two Waggons with Shovels, Spades, Mattocks, and ſuch like; and alſo one other Waggon with Coynes, Axes, Sledges, Hatchets, Bills and the like; and alſo a convenient company of Pyoneers or Mariners, and the like, in caſe they ſhould be imployed to make the Coverts and defences for theſe things, or to cut up buſhes, or to playn and prepare the wayes for the Ordnance. Now then in the Van-gard 4 Field-Peeces mounted upon their Carriages, and provided with Levers, Ladles, Coynes, Spunges, and ſuch like; accompanyed with one Waggon with Shot, and one with Powder, and one Lieutenant well experienced, and certain Gentlemen of the Artillery, one Mr. Gunner, and one Conductor.

After theſe, ſhall follow the quarter Demi-Cannons alſo mounted upon their Carriages, with one Waggon of Powder, and another of ſhot and ſuch like.

After theſe 4 Demi-Cannons alſo mounted upon their Carriages or in the Waggons with the Gynne-ropes and Levers, and finally, 5 Cannons with their appurtenances, and 4 Waggons with Powder, and 8 Waggons with round ſhot, Burres, Chaynes, with pieces of Iron, and other ſmall ſhot, which may ſerve to do great execution at hand, and theſe alſo accompanyed with the Gentlemen of the Artillery and the Conductor.

After the ſaid Artillery ſhall march in their Troopes and Bands, well ordered, 3000 horſe, and then ſhall anſwer 10000 foot-men, and after them ſhall follow the reſt of the Munition belonging to the half of the Army. *viz.* Bridges, Planks, Powder, Shot, Ropes, Shovels, Spades, Mattocks, Sledges, Crowes of Iron, Beetles of Wood, Bills, Hatchets, Sawes, and briefly all manner of Inſtruments and tooles both for Carpenters and Smiths, and all thoſe things that ſhall be needfull for the Artillery of the Vangard.

After theſe things ſhall follow the Victuals for half the Army, and alſo the Hoſpitall, then the Carriages of the Prince and other Noble men, and after ſhall follow the Carriages of the particular baggages belonging to thoſe of the Van-gard, and a part of thoſe in the middle.

Then ſhall march in the Squadrons well ordered 12000 foot-men, and in the Tayle an other Company of Carriages, with the Bag-

gage belonging to thoſe in the middle, and thoſe that march in the Reare-gard, then ſhall follow the reſt of the Victuals, as well for the Souldiers as for the Prince and Embaſſadours.

Then ſhall follow all the Munitions, and Engines ſerving for the defence of the Reare-gard, as the Artillery, Bridges, Boates, and ſuch like, then again 8000 foot-men ranged into 3 Battaliaes, being the Reare-gard.

After ſhal follow in good and convenient order as is deſcribed in the Van-gard 4 Cannons, 4 Demi-Cannons, and 4 Quarters, mounted upon their Carriages; and finally, 3 Field-Peeces, with their appurtenances, with Powder, Shot and all other Inſtruments which ſhall be ſufficient for men to uſe.

Then after theſe ſhall march 2000 foot-men ſerving to cover and defend the Artillery belonging to the Reare-gard, and the reſt of the Army, then ſhall follow 500 good horſe to diſcover the Fields and places neere about, leſt they ſhould be ſuddainly ſurprized or aſſaulted.

Now the Army marching in this order and that the Enemy ſhall find it thus fortified and provided as well in the Van-gard as their Reare, and the Ordnanee ready to defend upon all occaſions, and being divided as is aforeſaid, the Army devided into two parts the one part may ſtay in one intire body, and comprehend or keep the ſtuffe or baggage in the middle, and we ſhall not doubt by Gods help but to have good ſucceſſe and a good iſſue.

Gen. Surely this is a very convenient order & profitable for the Army and all his neceſſaries, which being well garded with men and the Carriages and footmen well ordered and devided, may ſafely defend the Artillery; but in *Hungary*, in this caſe is great diſorder; for there the Army doth march in one battalia or Troope, in ſuch ſort, that they cannot keep that Range and order as they ſhould, ſo that if they be ſuddainly aſſaulted, they are in great danger; wherefore I think that this your order may be well conſidered, which I will doe alwayes, as neceſſity ſhall require, without any more diſpute; now I pray you ſhew me what order is to be obſerved when the Artillery ſhall march a part?

Cap. Then certainly the Lieutenants are more troubled when the Artillery ſhal march apart in their bodies or Troopes, and there are many other things to be conſidered, which I will lay down in this order.

In

In the first Range, being the Van-gard, usually doth march the Pyoneers and labourers, with their chief Officers, that they may keep good order among them, that one doe not trouble another, and in the same, the Banner of the chief Generall, which is the first priviledge. The other is that when the Artillery shall march, that no other Carriages shall mingle themselves with that Trayn, except it be the Carriage of the Treasurer laden with Mony to pay the Army, for which cause, this is the proper place of this Carriage above all others; and I am sure that *V. S.* carryed his Kitchin and his Wardrobe upon Mules and Sumpter-Horses, that he might give a good example in this thing.

After these said Pyoneers, shall march certain Carriages with Spades, Shovels, and Mattocks, and other such like things, then shall follow the Artillery, and first the Field-Peeces mounted upon their Carriages, and charged ready for battaile or use; after shall follow the quarter Demi-Cannon also mounted and charged, then the Demi-Cannons also mounted upon their Carriages or Waggons, then the Cannons with two Gynnes, the one before them, the other after; and thus much for the Van-gard.

In the Reare-gard you must keep the same order, for after these Cannons shall follow all the necessaries and apresls for the Artillery; then the Bridges, Boates, and the Tents for the Chappell, and the rest of the Munition, and chiefly the Powder, and the House or goods of the Generall; except peradventure you may afterwards find a more convenient place for the same.

And for this cause, let the Forerunners and Quarterers go before the Chariots to make ready the Tents and places for the Powder, chiefly in time of wet or Rayne: After shall insue all the necessary apresls for artificiall fire-workes, with Ladders, Planks, Spikes, Nayles, Baskets, Baggs for earth for the Trenches; and then the rest of the necessaries for the Pyoneers.

Then shall follow the shot or Balls, the Muskets and Calivers; with Lead and other things, as Lances, Pikes, Habargions, Muskets and other apurtenances; and finally the shot for the great Artillery which ought to march immediately after the Artilery, that the small things may the better be free from the Horsmen of the Enemy, that may come into that place.

And in this order the Artillery may march without danger, al-

wayes provided that this be done by the advice and Conncell of the Campmaster and his Councell, which occasion in no wise ought to be neglected.

After this shall march all the other Waggons for the Generall, the Lieutenants and the Gentlemen and other Officers belonging to the Trayn of the Artillery, also the understanding that should be in the Campmaster and the Generall of the Artillery, for governing themselves and their Munitions, may proceed from their owne practice and experience.

After shall follow the Offices of the Suriors or Serjeants, to arest, Marshals, Carpenters, and finally the Provost for the Artillery, the rest of the baggage and the Victuals for the Trayn.

Moreover, if we be constrayned to march in a long Champion Field or Country, large and capable of the Trayn, this long Trayn may be shortned and knit together, being parted into 3 parts, in such sort that the Van-gard keep the right hand, the main battaile in the midst and the last equaling the Front, and so the Van-gard and the Reregard comprehending the Peeces of Artillery and their necessaries marching betweene them both, and then the Trayn shall be much more orderly, more short and more strong, and when the Champion or large Field shall cease, then the Van-gard, the Battalia and the Reare-gard as they were before, without any disorder or difficulty to be found in the Range.

Moreover if it falleth out that the Trayn of the Artillery march, there ought every other Chariot with the Carriage of the Peece which you will mount the same in hast to impeach the Enemy, then the Generall of his owne authority shall command a stay of the Trayn by his own priviledge, in a cause so weighty and profitable, concerning the chief and principall Instrument concerning the Warres without any contradiction of the first Range.

Moreover, that the better quarters be lodged or placed neere the water, and to be lodged before all the others, and not forgetting that all the service of the Trayn do rejoyce in these priviledges, see here worthy Sir, the understanding of the march of the Trayn of the Artillery by it self.

Gen. This doth give me great content, and sure it is of great importance; notwithstanding I desire to know how the Artillery and all his necessaries belonging to the Trayne shall be provided

in

in the place where they shall lodge.

Cap. Of this as much as concernes the Office of the Generall of the Artillery, I will declare first, that the Generall of the Army do give Commandement to the Generall of the Artillery or his Lievtenant, that he take good regard, first that he be lodged in a good houre, or time, that he may have time to oversee and chose out all the commodities necessary, and if it may be possible that he be so lodged, that he may command and discover the whole Camp at his pleasure, that is to say, for the first that all his wayes or approaches may be seene and discovered; Secondly, that the Camp may bee close and better defended, he ought to flanker the 4 sides; And thirdly that when the Enemy shall give an assault, he may defend himself with advantage, chiefly when he is lodged in the manner as is described in figure 6, first that there be a retrenchment made with Chaynes and Waggons, and such like, fastened one to the other, having a care that you give such place that the Infanterie may guard the same in necessity of skirmish, and let there be 25 Peeces in bredth between. Secondly that the Peeces of advice be alwayes 3, or 4, beholding or pointing to all the approaches of the Enemy, and that they be alwayes charged & ready for service; thirdly that the Waggons with the Powder be alwayes lodged in the middle or the center of the Carriages, as may more plainly appeare in the figure 6, which I have omitted, and referre you to the fourth book in all the figures.

Gen. The place is well drawne, and I am perswaded, guarded and set forth with all diligence and care, that if the Enemy should give an assault, the Generall should acquit himself with great honour and reputation.

But how shall we place the Artillery that in time of fight or Combat, we may offend the Enemy more grievously?

Cap. I make no doubt but *V. S.* is well experienced in his Wars in *Savoy*, and also in those in *Hungaria*, and it is not my part to recite those things, lest the Disciple seeme to be equall with his Master.

Gen. Why so? Is it not alwayes the custome in these affaires to take the report and advice of the old experienced Souldiers, and chiefly those that serve on our side, and for my part, I cannot boast of any great experience in these things, being imployed in other affaires in conducting mine own squadrons, so that I have had small

key sure

leysure to inquire after the Artillery, and because hereafter I may receive this charge, I pray you let me know the course of some experienced person in these quarters, how these things are ordered?

Cap. For my part to say the truth, I have seene but few battails on our side concerning this point; But I will shew you what I have observed in two battailes especially, In the one the Peeces were lodged in the Front of the Bands, in the other they were placed athwart or Traverse by two, and by three, and three, on the sides and ground of the sleeves of the Musquetry and Hargubusry, being covered and ayded by the Horsmen; But for my part, I esteeme it were expedient that we lodge certain Peeces in the Front that may endammage the Enemy on both sides, seeking alwayes for this effect the fittest place of advantage, that if the force of the Peeces in the Front be of little service, or choak or smother, being joyned neere the Squadrons may prove very offensive, which fell out in one of the said battailes.

Gen. And for this cause, I hold it more expedient the Artillery be placed in the sides of the battaile, leaving also the place of the Armes, to break and fire without any impeachment.

Cap. Truly Sir, I doe not find this so expedient, for the Enemy perceiving the Front without Artillery, shall be the bolder to assault and to force the same; Wherefore, I hold it more convenient that the Artillery be placed, and devided so as certain Peeces be placed in the Front, and one on every side, which Peeces ought to be distant one from another 50 or 100 paces, that in the encounter of the Enemy they may not choak or offend us; and by this meanes, we shall have roome to use all our necessaries, to turn our Ladles and Spunges, and our Peeces to the best advantage for our Squadrons, for the making of divers shots, a thing that imports a fayre Victory.

Notwithstanding, it sometimes falls out, that a battaile or place is not alwayes fit or commodious for the placing of the Artillery on a suddain, but we are alwayes oftentimes constrayned to prepare the same upon all occasions, that may fall out, as to cleere the bushes, woods, closes or other unequall places of the which we cannot give any certain rule, but must depend upon great prudence to foresee the advantages of the Enemy, and without hurt to our selves, as to observe the Sunne, the dust, the wind, the smoak and other such things, of small esteeme, but of great importance. But

But to return to our purpoſe, *V.S.* eſteemed it beſt to lodge the Peeces on the ſides a long time before he would approve of this courſe, but becauſe his Squadrons were again conſtrained to be like ours, by which meanes they were much offenſive to the Enemy; but in great danger, that the aydes of our Cavalerie did advance with much trouble of theſe Peeces, being placed on the ſides without the defence, which they ſhould receive from the ſaid Cavalrie, which ought to be guarded with all diligence.

And thus you ſee the ſmall experience that I can ſay in this point, advertizing all good Captaines that have ſuch things under their charge, wiſely to conſider theſe things, and to advance moſt couragiouſly to the endamaging of the Enemy.

Gen. This doth give me great content, now I pray you ſhew me what is the duty of the Generall in this caſe?

Cap. Truly then he ſhall ſhow both his Art and great wiſdome, which principally conſiſts in the Command of the chief Generall of the Army, and his Lievtenant, what order they keep in their Command touching the whole Trayn of the Army, and then the place appointed by the chief Campmaſter, it remaines that the Generall of the Artillery do devide and place his Ordnance accordingly, provided with all neceſſaries, and with a competent number of Gentlemen, Mr. Gunners, or Conſtables and Gunners, and labourers ſufficient, and finally that all the Field be well provided of neceſſaries ſufficient, as Muskets, Hargubuſes, and alſo of Powder, Balls, Match, Corſlets, Lances and other ſuch like things; all which the Generall of the Artillery is to ſee in a readineſſe, that when the chief Generall comes to view the ſame, he may find all in a ready and good order, and addreſſed for all advantages, and if the Enemy ſhall preſent himſelf that he approach as neere the Cavalry as is poſſible, he may with certain Peeces requiſit, and a due number of Pyoneers, and alſo a ſufficient guard for theſe things make defence, and he ought to be inſtant with the Campmaſter to have a place alotted him of all manner of advantage, for theſe things as much as poſſible may be, and thus you ſee the Office of the Generall in this buſineſſe.

Gen. This diſcourſe is very good and profitable, and you have ſatiſfyed all my demands with good and ſufficient reaſons; Now after this, let us know what is to be obſerved touching the Siege of a Town or a Fort?

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And thus you ſee the ſmall experience that I can ſay in this point, advertizing all good Captaines that have ſuch things under their charge, wiſely to conſider theſe things, and to advance moſt couragiouſly to the endamaging of the Enemy.

Gen. This doth give me great content, now I pray you ſhew me what is the duty of the Generall in this caſe?

Cap. Truly then he ſhall ſhow both his Art and great wiſdome, which principally conſiſts in the Command of the chief Generall of the Army, and his Lievtenant, what order they keep in their Command touching the whole Trayn of the Army, and then the place appointed by the chief Campmaſter, it remaines that the Generall of the Artillery do devide and place his Ordnance accordingly, provided with all neceſſaries, and with a competent number of Gentlemen, M^r. Gunners, or Conſtables and Gunners, and labourers ſufficient, and finally that all the Field be well provided of neceſſaries ſufficient, as Muskets, Hargubuſes, and alſo of Powder, Balls, Match, Corſlets, Lances and other ſuch like things; all which the Generall of the Artillery is to ſee in a readineſſe, that when the chief Generall comes to view the ſame, he may find all in a ready and good order, and addreſſed for all advantages, and if the Enemy ſhall preſent himſelf that he approach as neere the Cavalry as is poſſible, he may with certain Peeces requiſit, and a due number of Pyoneers, and alſo a ſufficient guard for theſe things make defence, and he ought to be inſtant with the Campmaſter to have a place alotted him of all manner of advantage for theſe things as much as poſſible may be, and thus you ſee the Office of the Generall in this buſineſſe.

Gen. This diſcourſe is very good and profitable, and you have ſatiſfyed all my demands with good and ſufficient reaſons; Now after this, let us know what is to be obſerved touching the Siege of a Town or a Fort?

DIAL. VII.

What is required of the Generall of the Artillery concerning the Siege of a Town or Fort, or any place.

Cap. IF there be a purpose to lay Siege to any place, the chiefe Generall ought to give great diligence to be informed by meanes of his Spies, that are inward with the Enemy, whether the place be Armed or defended with great or small Peeces of Artillery, and whether many or few in number, and also sufficient, or want of Victuall or provision for the defence of the place, as also to be certifyed of the scituation of the Walls, Bull-workes, Bastions, the places more strong or more weak, the aydes, Mynes, Countermines and such like, to the end he may make his Apresta to take the most convenient places.

Then he is to view the place himself, with great care and diligence, with as great security as possible may be; accompanyed with one of his Lieutenants and the Engineere for Fortifycations, and that he may know and search all about where to lodge that night following certain Peeces of Artillery, which shall serve to salute the Enemy by break of day, as well to prove their force, as also to incourage the assiegers, he ought also to see that the place or quarter be fit and commodious, in such sort that the Enemy may not discover his Peeces, and if this cannot be, then let him chose the most convenient place he can, and there raise a shoulder or defence with earth and faggots for his Peeces, and this is to prevent the Cannon shot of the Enemy, about which businesse, must serve the Pyoneers and Labourers, which are appoynted to that end, and that they may not trouble one another, they ought to be carefully divided, and every man appointed to his work or labour, as some to carry earth, some to carry Faggots, some to Romage, some for Gabions, and others to such matters as are requisit; others to place or lay all these things in their places, and also to place and appoint all things in good order and advantage.

But in times past, they did lodge the Artillery in this sort, the Infanterie did approach the Trenches even to the ditches of the Besieged. But within these few yeares, we have found out a more Warlike manner, and to be observed in this case; that is, the first night

night before the Siege, we place certain Peeces of Artillery that may be moſt offenſive to the beſieged, and this is a rule more ſecure and of greater effect to impoveriſh the Enemy, and in this we may have better time to fortify our ſelves, and give more courage to the aſſiegiants.

Which practice might be ſeene at the Siege of *Rinberke*, where the Enemy made a couragious Salley out, but the Artillery placed on our ſide in the Quarter of Count *Bucquoy*, on the ſide of *Oſry* made a ſtrong reſiſtance.

Gen. Surely Mr. Captain, this is good advice and of great conſequence; that the Enemy may alwaies be impoveriſhed in the begin ning, wherein moſt cõmonly he ſheweth himſelf moſt Couragious.

Now if it pleaſe you, let us ſee what meaſure and order is to be obſerved on our ſide concerning Batteries, for the ſhoulders or the Rampiers for defence from the Enemies Ordnance, and alſo concerning the planks for the Plat-formes, and other the like things that moſt chiefly belong to theſe defences, which will be both chargeable and dangerous to effect?

Cap. This thing is the charge of the Lievtenants and the Gentlemen of the Artillery, every one in his place fitting, and that they give order to the Carpenters, how they ought to prepare or fit the Planks and other neceſſaries for this great ſervice of account.

Gen. But I pray you now give me more cleere Inſtruction touching the meaſure and proportion of the Planks for the ſaid Platformes?

Cap. For the Cannon, the firſt Plank joyning to the Tronier or Turfe or Beard of the Rampier, ought to be in length 9 foot; the ſecond 9 ½ and the others following alwayes increaſing half a foot to twenty foot, and every Plank to be a foot and a half broad, and 4 inches thick, and making the Platforme for the recoyle of the Peece in length 30 foot, and the laſt Plank to be in length 19 foot ½, and ſo make the Platforme at the laſt then at the beginning broader by 5 foot ½, as for the elevation of the Platforme, that is to ſay, how much the Platforme ſhall be higher behind then before, I think it ought to be but a foot ½ in the length of 30 foot, that the tayle of the Carriage may gently reſt after her ſhot, and when the Peece ſhall be charged again, may be put up and brought to her mark with more eaſe. But there is ſome danger in this caſe, of ſhooting ſhort,

for there be ſome Gunners for their own eaſe, will allow more elevation of the Platforme, in which eaſe they do not onely ſhoote ſhort, but alſo the Peece after the ſhot doth return of it ſelf to the Troiſner or bank, and then it cannot be loaden again without great labour to get her back to be charged, and if it falleth out, that in the encountring of the Enemies Ordnance, it cauſeth to be thwart or Croſſe, you may loſe many of your Gunners and labourers, appointed to the ſaid Peece, and therefore this is to be well remembred, that the Platforme batter not above a foot $\frac{1}{4}$ in 30 foot, and the laſt Plank to be 19 foot and a half long, for the Demi-Cannon let your Planks be 18, and a foot and a half broad, and in thickneſſe 3 inches, the firſt planke to be in length 8 foot, the ſecond 8 $\frac{1}{2}$, and ſo increaſing alwayes half a foot to the number of 16 foot and a half, and make the whole Platforme in length 27 foot, and for his elevation or height behind to be but a foot and 3 inches, which is enough to break the violence of the reverſe; But this is alwayes to be intended to be when this Demi-Cannon is by it ſelf, for when it is in a Cannon battery, then you muſt allow as much elevation for this as for the whole Cannon.

Gen. Wherefore if you allow more elevation for the Platforme of the Cannon, then for the Demi-Cannon; it ſeemes to me rather the contrary, for the Demi-Cannon is more light or ſwift, and therefore the recoyle is more vehement?

Cap. The Cannon is more ſtrong and weighty, and have ordinarily 3 Gunners about it, and therefore it is that the Plat-forme when it is levelled with the earth towards the laſt plank, is raiſed to this height, to the end as we have ſaid, it might be reduced to his place, but the Demi-Cannon being more light to be handled, the Platforme may be made more equall, and by that meanes, make a more perfect ſhot.

Gen. Wherefore then do you make your Plat-forme more long for the recoyle of the Cannon then for the Demi-Cannon, for it ſeemes to me that a Peece being loaden with a due charge of Powder, ſhould make his reverſe proportionall alſo?

Cap. Not ſo Sir: for it is moſt certain, that this may be according to the quantity of the Powder, and the weight of the Peece; for the greater the Peece is, the more Powder ſhe requireth, for the Cannon ſhootes more quantity of Powder, and is more weighty

then

then the Demi-Cannon, and therefore muſt of neceſſity make his reverſe more ſtrong and violent, ſo that if one ſhould uſe this upon a Demi-Cannon Plat-forme, it would reverſe to the utmoſt plank and two planks over.

Gen. Let us ſee now what bredth and thickneſſe we ought to give to our defences or ſhoulders of earth, to the end our Peeces may be well covered and defended?

Cap. For the ſhoulder or defence, it ought to be at leaſt 11 foot high, and 23 foot thick, which is the thickneſſe of the proofe of a Cannon and ought neceſſarily ſo to be.

Gen. This me thinks is too much, but now tell me how long ſhall we make our Tenayles, or as ſome call them, the loop-holes, that theſe our Peeces may be well and fairely placed, and at eaſe, for them that uſe them, for feare of ſmoake and ſmothering and other hinderances?

Cap. For theſe we ought to make our Loop-holes, or Ports within 3 foot wide, and without 12 foot, and for the Demi-Cannon within, 2 foot and a half, and without 9 foot.

Gen. Why ſhould theſe things be ſo preciſe, and the difference to be ſo duly obſerved?

Cap. It is eaſily to judge, that a Cannon doth caſt forth a greater flame and ſmoak then a Demi-Cannon and is more violent and therefore requireth a larger ſpace in the Troiſner, then the other, and in this caſe, when the Troiſner or Port is too ſtreight, it is in danger to overthrow and ſpoyle all, by reaſon of the great force and violence of the Peece, and on the other part the ſhoulder or earth-work, will be much weakned by reaſon of the largeneſſe, and therfore it is a common order in all places, to make the Tronier for the Cannon half a foot larger within, and without 3 foot larger then the Demi-Cannon.

Gen. I deſire to underſtand if the ſhoulder which you appoint to be in thickneſſe 23 foot, were it not better if it were not ſo thick, for the ſervice of the Peece, and more eaſie?

Cap. I ſay touching this thing again, underſtand that by this courſe the ſhot ſhall be more right, and the Peece more free from the danger of the Enemies Ordnance, which by ſparing the ſhoulder, you ſhall much hinder the quick play of the ſhot; and therefore not reſpecting the eaſe in this caſe, it is moſt neceſſary that

the ſhoulder that ſhould defend and cover the Peece well, ſhould be of that thickneſſe.

Gen. It is true, for a thing well begun and performed, will in the end acquit the charge, beſides it is good to prevent the danger that may follow by this default, moreover notwithſtanding the great thickneſſe of the ſhoulder, yet the Troyſner or Loop-hole ſhall continue at the ſame height, and ſo all the Peece ſhall not be diſcovered and ſhoot in a ſtreight line and not decline either to the one ſide or the other.

Cap. When we will make a generall Battery, we ought to oppoſe right againſt the Enemy 100 or 150 paces diſtant in the which diſtance, one foot of the Troiſner ſhall diſcover 100 foot of the pane or piece of the ſaid Wall in ſuch ſort, that the Troiſner being 3 foot or 2 foot and a half within, we may diſcover 12 or 9 hundred foot of the Wall of the Enemy, which we meane to force or batter.

Gen. Sir there are two things that I would fain know, the one is whether a man may make a more perfect ſhot the Plat-form lying levell, or when the Plat-forme is raiſed behind; the other is when we make a battery, whether it were beſt to guard the Peeces with ſhoulders of earth or Gabions.

Cap. Touching the firſt, we have already diſcuſſed, and do affirm that when the Plat-forme is elevated, the ſhot is more right and ſtreight, ſo that it be not elevated more then neceſſity doth require, for then the ſhot may be ſhort, but being elevated ſo much as it ſhall break the force of the recoyle, and that it may be brought to his place with eaſe is beſt.

For the other, it is true that the Gabions are of leſſe charge, and more ready for uſe when the Enemy ſhall uſe but ſmall Peeces, but if you ſuſpect that he will uſe his great Ordnance, it is alwayes better notwithſtanding the charge and paynes to rayſe the Eſpaulx or ſhoulders of earth; again when we our ſelves will uſe our great Peeces, we ſhall not be in ſuch danger as we ſhall be with Gabions becauſe they will be apt to take fire by reaſon of the great force of our own Ordnance.

Gen. Now I pray you let me underſtand what diſtance ought to be kept between the Troiſner or Loopes in an ordinary battery one from the other in a ſtreight line?

Cap. For to give a convenient place or roome, as well for the Peeces

Peeces, as alſo thoſe that mannage them to load, Spange, Coole and refreſh them, and other things that neceſſarily belong thereto, we cannot demand leſſe then 20 foot, in ſuch ſort that the wheele of the one Peece be diſtant from the wheele of the next 15 foot, which is the leaſt that can be allowed, but larger if the ground allowed for the battery will permit.

Or for the Troniers you ought to mark this thing, that is to ſay, which of the inward ſides of the Platforme is leaſt uſed, and which is the larger, and which again is the deſcending part, to the end that the Peece may diſcover both above and below, not only the fields, but alſo the approaches of the Enemy, and that he himſelf ſhould aſſault the battery, and this of the Troniers as much as concern the Lievtenant and doth not depend upon the Generall, but upon the Lievtenant and the Gentlemen of the Artillery and the Conſtables or Gunners.

Gen. This gives me great contentment, now the battery being fitted, dreſſed and appointed with all his proviſions ready, what now remayneth concerning the duty and Office of the Generall of the Artillery?

Cap. The Generall ſhall give diligence to viſit all the Trenches and to ſolicit and ſee that there be no default in any thing, as well in the Infanterie, as the Cavalerie, as alſo thoſe that are imployed about the Artillery, and moreover that there be no ſcarſity of Powder, and other neceſſaries which he ſhall expoſe and give liberally to the Gunners.

When he ſhall begin the battery, he ought to incourage his Officers and Gentlemen of the Artillery, and chiefly his Gunners and Pyoneers, and promiſe them double pay for their good ſervice; moreover he ſhall procure that there be no want of water, Vineger and other ſuch things for the refreſhing and cooling their Ordnance when they are heated, and notwithſtanding the order of theſe things, he ought wiſely to choſe out a place convenient from whence he may mark and ſee all the ſhot and the effects that they work upon the defences of the Enemy, and give order for the mending of every fault.

Alſo if he perceive any Trench between two of his friends to be faulty, to give order that they may make preciſe defence, that they be not endammaged, alſo at the aſſault of the breach, to give order

to

to the Guuners that they do not play their Ordnance without expresse commandement, and having perceived all these things that in this case is broken or cast down, and every bank or hill that may be hurtfull, of which he shall advertise his friends with great diligence, that the Ordnance play not, or else when they shall play, and when they shall cease.

The Breach being forced, and the place gained, the first is that he shew the good honour to the chief Generall of the Victory, which he shall lovingly receive.

After being accompanyed with his Lievtenant and Campmaster, he shall himself enter the breach, and curiously view and search whether there be any Mynes, or any Traynes of powder, or any smell of fire appointed to fire any Trayn at any certain houre or time, and what Powder or other Munitions or Armes he shall find there, to give account thereof to the Campmaster; and moreover he shall visit the Peeces of Artillery, and mark whether any of them be faulty or cracked, or broken, and make report thereof to the Prince or chief Generall, and solicit for his Gentlemen, Constables and Gunners, for due recompence for their diligence.

And finally, if there be question of the going forward of the Army, that he procure that if the wayes be difficult, rugged or bad, to have them made fit and serviceable by the labourers and Pyoneers, for the passing of the Artillery; and if they be to passe any water or River, to give order to the Carpenters, Mariners, or men requisit for the like businesse, to advance Bridges and such like at a time appointed, and that they be not long about the thing to be done, and let him chose certain men for that effect, as Carpenters and other Artificers, with a sufficient guard to passe over to the other side with men and small Peeces of Artillery to resist the Road and assaults of the Enemy that would impeach and hurt them, and thus you see the principall thing required in the duty of the Generall of the Artillery.

Gen. I thank you Sir, for you have given me good satisfaction in this thing, and I am very joyfull thereof, and for this cleere instruction, now let us see also the other charge and duties, and chiefly let me know the Office and duty of every Officer by himself?

DIAL.

DIAL. VIII.

The Deſcription of the other charges, and the duty of every Officer by himſelf.

Cap. AFter the Office of the Generall, followeth the Office of the Lievtenant, unto whom in the abſence of the General is committed the whole charge of the Artillery to command the whole Trayn of the ſame, and to ſucceur, help and relieve the ſame as much as is poſſible, and beſides this, the diſtributions and the guards and the Munitions, depend upon the Office of the Lievtenant, and firſt the quarter for the Lievtenant is to be placed neere the Generals quarter, that he may approach the ſame, and as they ſay, bid him good morrow, that he may enquire of him of the affaires of the quarter, and other things concerning the Artillery, according to the inſtruction given to him by the Quartiller or the Mr. of the Camp, and accordingly thereto to diſtribute the work to the labourers equally, that one may not be more charged then another.

At the Siege of any place in the Evening before he ſhall be preſent before the Tents of the Munitions, and ſee the diſtribution of the ſaid Munitions and of all thoſe things that order require for the Trenches and other covertures for the Artillery, and carefully and diligently to intreat or requeſt the Mr. of the Hoſtile and the reſt for ſuch things as remaine under their hands, and to viſite the Generall and take his advice and counſell and direction in all things.

In the night he is to walk the round of the Trenches and batteries, and inquire of the Gentlemen if there be any default concerning the Munitions, fortifications or coverts for the Peeces, and if any be to give order for the preſent ſupply thereof, and to walke a turn in his lodging, to ſee if he can deviſe any new ſtratagem or device, and preſently to put the ſame in practice without any delay.

When the Army ſhall march, that he be ready alwayes with the Trayn in his own perſon, which is a ſingular effect, that there be no default or want of any thing belonging to the Ordnance, nor no diſorder or wans of proviſion, and to order things ſo that one man doth not hinder the other.

The Trayn thus ſet in good order and arived to the place of Armes that then he doth devide the Peeces among the Gent. and the Carriages and Waggons among the Conductors, and walking the round amongſt them to ſee that all things be placed in their place, and the Conſtables and the Gunners alſo, as well for the Artillery as for the perſon of the Generall.

Moreover when there is queſtion of Founding any new Peeces, he ſhall viſit diligently all the Formes and moulds of the ſame, that they be well dryed and made according to reaſon and proportion, and when the mettal is in melting, to ſee that there be no other mixture in the mettal then is fitting in that behalf.

And moreover that when the Lieytenant of the Generall cannot be there, that he deſire the Mr. of the Hoſtile to aſſiſt him, and in his abſence to take theſe things into his charge, and into their own care and induſtry for the underſtanding of thoſe things, about the Founding of Ordnance is a moſt eſpeciall thing, concerning the defects and faults of Peeces.

The Peeces being caſt or Founded, that he ſee and regard if they be right boted, equall and no neeter on the one ſide then the other, and cauſe them to be viewed by good and expert Gunners, how they be within, as when the moulds be not well dryed, there be cracks and flawes, called of ſome Gunners hony-combes, and theſe Peeces are moſt dangerous for them that mannage or uſe them, of which I will tell you an example which I my ſelf have ſeen.

There was a Gunner that after he had ſhot off his Peece and the Mr. Gunner as the manner is, had cauſed him to Spunge well the ſame, which he did and not perceiving any fire in the ſame, he haſtily taking the Ladle loded her again, and in turning the Ladle to empty the ſame, the Powder took fire and diſpatched the poore Gunner.

Now the Mr. Gunner ſeeing this, and thought it might fall out by negligence, takes the Spunge himſelf and Spunges the Peece with great diligence 3 or 4 times, and ſeeing it was well Spunged charged the ſame, and had the ſame event that the other had.

And therefore there is great reaſon to be diligent in ſearching ſuch Peeces, which ſmall fault in the beginning may ſo increaſe till the devil in the end brings men to this diſaſter.

Now when he ſhall prove theſe new Peeces, that he take great heed

heed that there be no compact or agreement betweene the Gunners and the Founders, least the Gunners give leſſe Powder then they ought, and alſo that they be charged according to that height of their mettals, even as the rule in that behalf ſhall direct, and for that cauſe, it is fit if it be poſſible, the Lievtenant ſhould alwayes be at the proof of the Ordnance.

And when he finds that the Generall meanes to viſit any of his Townes, Caſtles or Forts, and that he be there to ſee how the Artillery, Munitions and all other things concerning the ſame be governed.

And now ſee alſo, omitting many other ſmaller things; the obligation and duty of the Lievtenant of the Generall of the Artillery, and how he is to acquit and behave himſelf, which in the abſence of the Generall is to take charge of the whole Trayne of the Artillery.

Gen. This is truly a charge of great conſequence, and requireth a perſon of great account and experience, that he may ſerve readily and prudently in all theſe occurrents; let us ſee alſo the other Officers, how they depend and follow one another.

Cap. The next that follow this is the Gentlemen of the Artillery, or of thoſe unto whom it is impoſed, that when the Army and the Trayne of the Artillery ſhall march, they ſhall ſee that all the Peeces committed to their charge be well arived into their quarters, and to guard them every one in his place, till they receive commandement from the Lievtenant or his deputy.

In the day of the battail that every one of them do aſſiſt 3 or 4 Peeces, and haſten diligently the ſhot, and to ſee that they be well made or imployed, but alwayes to take heed that they do not meddle with the laying of any Peece or making any ſhot, or appointing the ſame; but to uſe what diligence they can to give notice to the Gunners how the ſhot fell, either wide, gone or ſhort, as occaſion ſhall ſerve; and to ſee and cauſe the Gunners to amend the ſame, for to lay the Peeces and to make the ſhot, doth properly belong to the Gunners, and they will greatly deſpite them, and take it very ill if they meddle in their place or Office in this caſe, and that will ſet to their hands by force about any Peece, of which I have ſeen many mad pranks, and examples played by divers froward Gunners, for this thing about thoſe that will offer to

charge a Peece with lesse Powder, and the shot shall fall short, or mount her too high, or to give her too much Powder, and the Peece may break and spoyle the men that are about her, and the Gunners must not be toused or medled with about making their shot.

When the Army shall approach to view any Town or hould, that the Generall shall advance to view and know the strength thereof, and to chose out the place of the battery where it were best to be placed, the Gentleman of the Artillery though the danger be great shall accompany the Generall, and therefore he shall be armed at all points, he shall go formost, and shall without feare ingage himself courageously, and informe the Generall of all the defences of the Enemy, and by what meanes he shall place the battery, and finally to observe and put in execution all the order and command of the Generall, and appoint the labourers and Pyoneers to their work, to make Rampiers, and defences and Trenches, and with great haft and speed to effect the same.

It is also the duty of the Gentleman of the Ordnance to rouse and stirre up the Gunners with great instance to shoot and make their shot diligently and with great force to beat down any defence of the Enemy, and that there shot be made in good time and order that if it be possible they loose not their effect.

After the place is taken or won, at the command of the Generall he is again to see the Peeces again placed in their quarter ordinary, and to be brief, he is to shew himself loyall, ready, diligent, and very coragious in all his businesse and Commands whatsoever, the Generall also shall be carefull also to chose out men of good account and personages, of good name and disposition, and prompt, and lastly to labour in performing this excellent service, to be the Gentleman of the Artillery.

Gen. This is good advice, and of great importance to imploy in this charge valliant and brave Souldiers, and persons well experienced, now what Office is next in order?

Cap. After the Office of the Gentleman of the Artillery, followeth the Office of the Conductors, having the charge of the Waggons and Carriages, that they keep good order, according to the purport of the Generals Lieytenant, who shall cause them to bring all such necessary provisions as is fitting, and that they acccompany all such Chariots or Carriages, and also that every one be found

found at the battery in his appointed place, and to be ready to execute the Command of the Gentleman of the Artillery in ſuch things as he ſhall think fit, and for this charge the Generall ought to choſe ſtout able men to undergo the travell and to performe the ſervice.

After this doth follow the Office of the Conſtables or Mr. Gunners, and their duty is firſt when there is a battery to trace and ſet out the Troiſnes and defences for the Ordnance, and then to return to the quartiler and to view diligently all his Peeces with their aprells and neceſſaries, their Ladles, Spunges, and to cleere and Spunge his Peeces, and they being well brought to the battery and placed, to deliver them to the Gunners, appointing to every man his charge with all other neceſſary proviſions, as Coynes, Levers, Ladles, Rammers, Spunges, Balls or ſhot, Powder, Ropes and other neceſſary things.

Alſo he is to give preſent order for making of the Platformes, that they be made according unto rule and Art as is required, alſo if the Gunners ſhall break or ſpoyle the Ladles or other things belonging to the Artillery, he ought to furniſh them with others, and with skill and diligence to fit and prepare ſuch things himſelf that nothing be wanting, and alſo to provide Hatchets, barres of Iron, Levers and other things, that there be no defaut.

He ſhall alſo aſſiſt the generall batteries of all the Peeces, advertizing the Lievtenant and the Gentleman, when it is time to refreſh and coole the Peeces.

After the battaile all the balls or ſhot ſhalbe brought together, and he ſhall Caliber the ſame with great diligence, and laying them ſo ſorted together on divers heaps, the great by themſelves, and ſo the reſt according to their bigneſſe by themſelves, to avoid all diſorder that may befall for want of care in this thing, that is to ſay, when one ball is taken for an other, either too ſmall or too great, the ſmall will make a ſhort ſhot, and the great may enter well at the beginning but may ſtay in the middle, in ſuch ſort, that it will goe neither backward nor forward from the place where it is, wherein we may loſe much time, and forſlow ſome good occaſion; then let him take a prety quantity of water, and put into the touch-hole to break the force of the Powder, then putting ſome dry Powder into the touch-hole to fire the reſt, let him give fire and blow out the

ſhot eaſily out of the mouth of the Peece.

Alſo he is to regard that all his Gunners be provided of their Inſtruments, as priming Irons, the one bigger then the other, a ſteel to ſtrike fire, and a Semiter or ſhort ſword, and his Lintſtock, a payre of Compaſſes, a Sight-Rule, a Quadrant, a ſmall line to meaſure the thickneſſe and fortification of the Peeces, and principally Flaskes or hornes filled with good Powder and fine, for to pryme the Peeces, which is better then to take it out of the barrel with your hand.

At the Founding of new Ordnance he is to have a care to ſee if there be any faults therein, and to advertiſe the Generall of the ſame, that they may again be broken.

Alſo he ſhall have his ſtaffe or long Lintſtock, to the intent he may be known to be the Mr. Gunner, and pryming Irons of all ſorts, if any Peece ſhould be ſtopped or cloyed in the touch-hole, that there be no ſtay in the fyring, as one with a ſcrew, another with a wimble bit, another with a hooke to take hold of the mettal on the inſide, to know the fortification of the mettal, alſo a Quadrant divided into 90 degrees with a plummet thereto belonging, to take a diſtance or to mount a Peece to any elevation, and alſo a Sight-Rule.

Moreover, he is to underſtand the compoſition of Powder, and the skill in making all manner of fire-workes, as well for the Warr as for tryumph and paſtime.

He ſhall be alſo diligent to inſtruct his Gunners that are under his charge to handle their Ladle and Spunge gracefully and comely and to charge their Peeces nimbly and quick, ſhewing them in his own perſon how they ſhal behave themſelves, & to let them know, that a diligent ordinary Gunner will prove a good Conſtable or Maſter Gunner.

When there is any buſineſſe for the Gunners, that he recite the ſame at large unto them every one his charge and duty, and thoſe that are painfull and induſtrious to incourage them, and to diſgrace the negligent and ſlothfull, and to declare the names of the good, as of the bad unto the Lievtenant, as well of the good that they may be countenanced, as the bad that they may be puniſhed and diſgraced.

The Orders of the Labourers about the Ordnance, with their chief

chief Captaines ſhall alway have in readineſſe their Cords or handlines, that they may ſerve to meaſure the Peeces to place them in a true diſtance at the battery and other things thereto belonging, and moreover when the Army ſhall march, they ſhall ſee that the wheeles and the extrees be well greaſed, as well of the Ordnance as the Carts and Waggons, that they may be drawn eaſily, and alſo that they take not fire in the journey.

If there be queſtion of mounting or diſmounting the Ordnance upon their Carriages, theſe men ſhall attend with their Cords and other things appertaining thereto, in the charge or diſcharge of the Munitions, theſe ſhall be alwayes ready to attend and aſſiſt and help upon all occaſions, from the beginning to the end; and ought alwayes to carry the Munitions to the Tents, and theſe are all bound or obliged to ſerve at the batteries, not onely to carry and tranſport the Munitions, but alſo to ayd, aſſiſt and help about the Artillery, their Captain ſhall take ſuch order with the Lieutenant, that they may be ſo divided that every one may know his own buſineſſe or work, and then there will be no diſorder, and every one ought to be of good judgement to diſerne and provide for ſuch occurrents that the Mr. of the Hoſtile be not troubled at all, and he ſhall alwayes uſe ſuch diligence and loyalty that he may render a good account of all things that ſhall paſſe under his charge or hands.

The Coopers ought alſo to be found neere about the Tents of the Munition,, to fit and hoop the barrels of Powder, that the Powder be not loſt, and alſo to be at the batteries to make ſtrong the Powder barrels, theſe men alſo ought to be of a gentle behaviour, and of good credit, becauſe the Powder is recommended to their charge.

The other common Artiſans, as Smiths, Farriers, Lock-ſmiths, Carpenters and ſuch like, are of great neceſſity in the Army, and chiefly about the Artillery, every one of theſe have their proper obligations and duties, the Smith to do the Iron work about the Carriages or Waggons, and to ſtrengthen them, and to choſe out thoſe that are moſt fit for labour, and the Lock-ſmiths to furniſh them with other Iron-work.

The Carpenters are alwayes to attend after the Artillery to mount or diſmount as need ſhall require, any Peece with their Gynnes and blocks to give way and to liſt up and enter the other

Inſtru-

Inſtruments as need ſhall require, more readily theſe men ſhall accompany the Artillery to the battery, and theſe men ought alſo to be imployed in the buſineſſe of the Plat-formes and other Carpenters work.

The Carters or Wagoners ſhall prepare and fit the Extrees and wheeles as well of the Ordnance as of the Carts and Waggons, and if any of them be faulty or cracked, to amend and ſtrengthen them as much as is poſſible, to ſerve the turn till others may be had, they ſhall cut or fell wood as well for themſelves, as for thoſe and ſuch like neceſſities, as alſo other things for Helves for the Axes, and other tooles by order from the Generall, and to furniſh the Waggons with the ſame.

During the journey we ought to Levy othe Carpenters extraordinary to help and aſſiſt theſe as well in the work of the Artillery as in other occurrents, and theſe ought to have a Maſter or Superiour which ſhould be an Ingineer if we intend to make Bookes or Bridges, or to furre the Mynes or the like.

The Myners ſhall be diligent in their charge when they are commanded their work.

The Marriners ſhall alwayes do their ſervice about the Bridges, and if the Army ſhall paſſe any River, they are to ſerve with their Plate and Boates, beſides alſo at the battery they are to aſſiſt the Artillery in thoſe things that they are Commanded.

The Calkers ſhall alwayes wayt upon the Boates to ſee if they have received any hurt, and be alwaies ready with their inſtruments or tooles to amend them.

The Mr. of the Artificiall fire-works ſhall with their Ingineer be alwayes ready to moleſt and endammage the Enemy, ſhooting all manner of fires and compoſitions thereto belonging, according to their Art.

The Petardiers are to be commanded as occaſion is offered, to fit and prepare their Petarrs to break open Gates, Bridges, Walls, and other repayers, and defences made by the Enemy, that may hinder and impeach the paſſage of the Army and the deſignes thereof.

Touching the Provoſt, he is to attend his quarter in the Field, and to ſet good order among the Viuanders following the Trayne, that the Chariots doe not occupy too great a place in the Army, and chiefly

chiefly that they meddle not with the Carriages of the Munitions, and that they ſet a juſt tax upon the Victuals according to time and place, and as it is valued in the adjoyning Villages.

Item, That he provide good guards and Convoys for the ſaid Victualers, in ſuch ſort that the Army be not enfeebledr hindered.

Item. That with great diligence he doth make the round in his quarter, and to apprehend any Malefactor which may be found in the body of the Army, and to deliver him to the Provoſt Generall, if he be of his Trayn, and advertiſe him of the forfeit and puniſhment due unto him for his offence, that he may have juſtice accordingly.

Alſo he ſhall be ready to diſpart or devide the Trayn, to the end that there be no debate or diſcention about thoſe that belong to the Van-gard or Reare-gard, and to wayt upon the Generall or his Lieutenant in caſe he ſhall be commanded any ſervice.

The Quartermaſter or Maſter quartier, is a charge moſt laborious and painfull; he is to receive the Watch-word every evening, and other inſtructions from the Mr. Generall of the Camp, and give it to his Generall and his Lieutenant.

Item. He is to divide the Munitions and Victuals among the Souldiers.

Item. He is to demand his quarter of the Generall Quartiler or Quartermaſter.

Item. If it be ſo that the Trayn ſhall march, that he appoint the guides, demanding thoſe guides of their chief, and chooſing them out of the moſt able and ſufficient men for that ſervice, to conduct the Artillery, and alſo appointing them the way they ſhall goe.

Item. That he make out the quarters for all the Trayn, and trace and draw out the place of Armes, and then lodge every one in particuler, from the Generall to the meaneſt in the Trayn.

Item. That when any forrage or provant is brought in, it is to be committed to him, and he is to make diſtribution thereof equally to the content of every man, alwayes regarding the time and place either of abundance or want; and ſo much is required of this Officer in many things that I omit divers other, being well aſſured it is the moſt painfull Office in all the Trayn.

The Engineers and such as draw Plats, are bound to trace out the Trenches, and the Fashion most secure and convenient as may be, giving also order that they may be made accordingly.

Item. To rayse Bulwarkes, and fashion out Platformes, Bastons, Cavillers, half Moones, and other re-intrenchments, proper to this effect, as well for the defence of our friends, as the offence of our Enemies.

Item. That he mark well the distances of places, the bredth and depth of Rivers and Ditches, the height, length, and thickneffe of Wals and their curtaines, besides many other particular things depending upon this Science and Art, is required in this Officer.

The Pyoneers, labourers and other in this kind, that are hyred to cut wood and faggots for the use of the Gabions and other such necessaries, digging and remooving of earth from place out of the Trenches to the Rampiers and Parapets, and other such parts of their labour, as well for defence as offence; again, when the Artillery shall march, they are alwayes to accompany the same, and because you shall not marvell why so great a company is demanded, mark but one or two mile where the Artillery hath marched, and you shall perceive the great need and use of these men, and the great multitude therof to be had and allowed, as well for the speedy making of Trenees and fortifyeations, as for other occurrents.

But let them not be as naked men, as customarily they are, but let them have some Armes, as short Swords, Partisans, and others with Pistols, others with half-Pikes or Glaves short and broad, after a meane manner, and the present opportunity, being never in the Warres before; and these hands shall not onely guard the Trenches, but also the Artillery it self; again, they excuse and bear out a great payn of the Souldiers, by their work, which oftentimes being weary, may be imployed to guard the Artillery, though it be without profit, and also great danger, because many times it fals out that one company being in the way and tyred must needs stay behind, in the Reare in which place they are voluntary imployed again when the Generall shall command service in other affaires, as to approach with the Ambushments to the Trenches, or to the foundation of the Walls, to Myne and such like; and therefore the Generall ought to love and make much of these men, because they do oppose themselves to such great danger, and to excuse them of the

the ſtealth that they make at the change of their watches, being a thing common to theſe kind of men of what Nation ſoever, when they break up their watch to pilfer and ſteale ſome Cords, ſome Match, ſome Powder, ſome Shot and ſuch like, and if any complain to the Captain or Mr. of the Hoſtile, they will anſwer they are poor men and ſerve Valiantly, and therefore wink at it; a bad anſwer in ſuch a matter of account, which ought to be handled with more equity; and therefore it is better to imploy no more of thoſe kind of men then needs muſt, about the Artillery.

The Tendiers are obliged that as ſoone as the Trayn come into their quarters, that they be ready preſently to raiſe the chief Tents. *viz.* The Chappell, the Munitions, and afterward the lodging of the Generall, his Lieutenants and other Officers.

And thus much at this preſent ſhall ſuffice to ſpeak of the Army of his Majeſty.

Now for the Gunſmiths and Armourers, if there be any I could wiſh that 2 or 3 of them may belong to the Trayn of the Artillery, becauſe it falleth out often among ſouldiers, that the things belonging to their Peeces do faile and break, and ſo they are deſtitute of meanes to repayre the ſame, except ſuch Artificers be ready to help at their need.

Again, alſo if there be any fault in a nayle in a Corſlet, or any default in any joynt or otherwiſe, and therefore it is good to imploy ſuch men not onely in theſe occurrents, but alſo in making of ſuch Armes which the Generall ſhall cauſe to be well proved both for the mixture and temper of the mettal.

And thus I conclude the recitation of the perſons and Officers of the Trayn of the Artillery, and the duty of every particular Office by it ſelf; now let us turn to our batteries and the faſhion thereof.

DIAL. IX.

Which Peeces are moſt forcible, thoſe that lye in the plaine, or thoſe that lye in a Town.

Gen. NOw we have made inquiſition of batteries and other dependances, I deſire to know of you, being a man of Experience in theſe affaires, when there are certain Peeces equall

in battery and counter-battery; which are moſt in danger, thoſe that are lodged on high upon the Walls, or thoſe that be in the plain Field, making account that the Peeces are equall and their differences alſo equall?

Cap. This thing about the which you deſire an anſwer is that which J my ſelf have both ſeen and tryed. *viz.* That thoſe Peeces that are lodged upon the Town Walls, being more high then they that lye in the Field, I ſay that they that are moſt high are in moſt eminent danger.

Gen. This is very ſtrange to me, that the loweſt ſhould ſurmount the higheſt, and for my part I would think rather that the Peeces ſhall be beſt, conſidering that a man may the better diſcover the plain or Champion, and therefore the ſhot ſhall be more vehement.

Cap. For my part, and ſo much as I know in Artillery, that when the Artillery is lodged in the Field and well defended with Rampiers, and Troiſners, I had rather ſerve with thoſe Peeces then thoſe that are lodged upon the Rampiers or Walls of a Town. *viz.* Figure 9.

Gen. I beleeve this, becauſe you are not ſo incloſed in the field, but that you may be ayded and provided, which the beſieged cannot be.

Cap. Jt is no matter for that, but I am aſſured by experience, that the Peeces below, ſhall play with more and greater advantage then thoſe that are on high.

Gen. I pray you give me ſome reaſons for the ſame?

Cap. I am content ſo to do, as cleerly as my skill doth lead me, well then the reaſon is this, that the Peeces below doth make their point to the baſe of the Wall or Barbe of the Peeces on high, and ſtrike into the Port or Troiſner, but becauſe of the imbaſing of the mouthes of the Peeces on high beyond their proper uſes, ſhall cauſe the Carriages, Extrees or Wheeles to break and be out of order, and cannot long be ſerviceable, which J have obſerved in divers places, that have ſo been placed, where the moſt part of the Artillery there have been diſmounted by this meanes, and this cannot fall out in Peeces which are below, for the Carriages of the Peeces and the Extres are covered with the mettal of the Peece, for the moſt part in ſuch ſort that the Ball from on high ſhall fall more eaſily, and falling

ling upon the Peece shall glance away and do little harme, it may fall so right that it may hurt no person, or if it fall on one side it may spoyle a wheele, which may soon be repayred and for the motion of the Ball I am assured that that which is below is of greater force then that above, for that above will be resisted more easily, and will glance away, when the other below shall have a greater stop or counterbut more rude and vehement.

Gen. But those that are on high shall better discover the Peeces that are below, which after that they have made their recoyle by meanes of the violent discharge, certainly by that meanes then the Peeces not only, but also those that are about them occupyed in the service, shall be discovered and in great danger to be knocked down by them above, and those above the more they recoyle or go back, from their Troyners, the more secure they shall be and all their assistants.

Cap. This is true, there may be some danger, but then we may heighten up our Rampiers or Espauls in such sort, that the Peeces may be covered that the Enemy shall not discover so farre into our battery by meanes of the height of our works.

Gen. But say the Enemy shall shoot right into the Loop or Troisner, it cannot fayle, but the shot from on high shall rebound upon the Peece or some other thing, and either break the Carriage or spoyle those that are about the Peece.

Cap. The danger is not so great as you think, for the Ball that cōmeth from the height and especially that which hits the Tronier, shall fall into the earth and bury it self there, but if it doe but grase, it will lose most of his force and mount over the Rampier Curtain or Murall, and if the Gunner be diligent and quick to gain the hand of his Enemy, in such sort that he hath laid his Peece and taken his levell or aym, marking when the Enemy shall bring up his Peece forward to his Troyner, and then presently give fire if the Peece be well layed, sance fayle he shall mouth his Peece, and so cannot his Troisner, that he shall have small assurance of his shot, which he would have if otherwise it had been followed, and therefore *F. S.* and I also do affirm that the Peeces that are lodged below are of more advantage by much then they that are above, and those on high shall fayle to mouth their contraries, and they below shall always endanger the Carriages, Wheeles, Extrees, Murals or such

like, and our Extrees are covered in ſuch manner that they cannot be hurt.

Now I will tell you a ſtory which fell out in *Oſtend*, at which Siege in the Cauſey of Count *Bucquoy*, being ſomewhat lower then the Town, it fell out that becauſe they could not in the night, they were conſtrayned in the day to build a little Fort, but the Enemy by reaſon of the continuall play of their Ordnance, did much impeach and hinder the ſame, by the which trouble they were conſtrained to withdraw from that place, then Marqueſſe *Spinola* perceiving of what uſe that ſame would be, gave commandement to lodge upon the ſaid Cauſey certain Peeces to this effect, but he could lodge but 9 againſt 12 of the Enemies, then in an houre and a half he removed all his Troniers and defences, the defences of the Enemy being then ſo high, that they could not bring their Peeces to that ſervice, by reaſon of the height of the earth-workes made before, and could ſhew nothing of the Peeces but the Friſes, or Dolphins made for Ornament of the ſaid Peeces.

Gen. Which ſhot is moſt violent and of greater force, that which cõmeth from on high downward, or that which ſtriketh counter-mure, or levell?

Cap. Surely, that which cõmeth from below towards a hill, ſhal loſen more by much then that which ſtriketh levell which *V. S.* did not perceive that the nature of the fire doth alway tend upwards, and therefore of greater effect againſt a hill, then down towards a Valley, and the Cannon levell, or as we ſay, the Peece upon her mettal, will carry further then the Peece with the diſpart, or that which is levell, or parallel with the Cilender or Soule of the Peece. *viz.* The Ball is driven forth more violently then that which is parallel or levell with the Cilender of the Peece, as may appeare by the Figure adjoyning; at *Amiens*, *Chriſtophal de la Cuga*, did fit certain Peeces for counter-battery (being Lievtenant to the Generall of the Artillery) hoping to diſmount the Peeces of the Enemy, but he quickly loſt all his Troiſnet in the battery.

Gen. This may well come to paſſe, either becauſe his Peeces were not well lodged, or for fault of a fit and convenient place?

Cap. For want of place convenient it could not be, but for the other in not having ground ſufficient to lodge his Peeces, I dare not ſay any thing of one ſo experienced in the Warres, and a man of

note

note in this point of Artillery; But the like example alſo fell out at *Oſtend*, which confirmeth me more and more, and I do hold that the Peeces that are placed below are more advantagious then thoſe that are lodged above.

Gen. You have well ſatisfyed me in this thing, but I confeſſe by theſe reaſons you have alleadged, I have been abuſed. But now becauſe it is dinner time, we will leave of our diſcourſe for this time, and after dinner we will handle another queſtion, whether a Peece upon a Tower or at the foot will carry furtheſt?

DIAL. X.

Of Peeces equall, which will carry furtheſt, that which is lodged upon the top of a Tower, or that which is placed at the foot of the ſame.

Gen. CAptaine, I deſire to be reſolved of the doubt that I ſpake of before dinner, of two Peeces equall, or ſay it were all one Peece, the one lodged on the top of a Tower, and the other at the foot of the ſame, which of thoſe Peeces will carry furtheſt?

Cap. I have no great experience in this thing, and therefore can give no cleere or perfect reſolution.

Gen. But in the meane time let me know what you think concerning this thing?

Cap. Then to ſatisfy your deſire, I think the Peece that is above ſhall out-ſhoot that which is below, being equally mounted or elevated.

Gen. And why ſo? I ſhould think rather the contrary, for the Ball on high ſhall be more apt to gather wind, which may let or hinder the courſe, as we many times ſee by experience, that the wind and Ayre do many times hinder the courſe and flying of a ſhot.

Cap. It is very true, that the wind and Ayre is ſome hinderance to a ſhot, yet notwithſtanding the Peece below is not much exempted from the ſame, but ſhall be as much ſubject to the Ayre as that above, for before it ſhall reach the height of the other Peece, the force of the ſhot will be much abated; but that which is upon the Tower ſhall be rather increaſed.

Gen.

Gen. These reasons are but indifferent, and in my opinion are but of little force.

Cap. These reasons are most certain and naturall, that that Peece that shall shoot furthest must be mounted highest by the Quadrant, which is 45 degrees, or the 16 point from the Horizon, and therefore it is further from the Horizon then that which is below.

Gen. By this therefore it seemes to me that the shot shall be more short because of the Ayre, and will be more abated of his force then that below.

Cap. It is true that a Peece mounted above 45 degrees or the 16 point, shall shoot shorter, because it is mounted above the uttermost Randon, but the Peece on the height shall shoot further then that below by so much as the height of the Tower commeth to, as may appeare by the Figure 7 at *A*.

Gen. What is the difference of the flying of the shot from the beginning to the end?

Cap. The shot hath three divers motions, the first from the beginning as soone as it cometh out of the mouth of the Peece, which by reason of his violence maketh a streight line, this is called his violent motion; the second beginning from the streight line maketh a crooked line or arch, and doth participate of the violent and naturall motion, this is called his mixt motion; the third, which doth begin at the last end of this mixt motion, and so falleth perpendicularly to the center, is called his naturall motion; as may appeare by the Figure.

Moreover, for any other question that may arise touching this point, I referre me to a certain Author that hath written of this point, called *Nicolas Tartaglia*, for my part, I can give no further resolution thereof, but leave the cleering of this point to more ingenious spirits.

Gen. I think it is somewhat hard to them which are not experienced in this point, but I doubt not but that it might be soon proved; but a long time agoe I disputed with one that held a strong opinion that the Peece below would carry furthest, and he caused me in some sort to be of his mind.

Cap. If it were so that a Peece lodged below should carry further then a Peece upon a height, to what end then serveth so much labour and cost to raise mounts and such like, to raise the Artillery

and

and to heighten up the same; which is done with great danger and much labour.

Gen. I am of opinion that this is not done to advantage the length of the shot, but rather to discover the Field with more ease and liberty, and to command over all the designes of the Enemy.

Cap. I remember once we were constrayned at the Siege of a certain Town, to lodge our Peeces further off from the same then is usually accustomed in such businesse, and being commanded to try whether our Demi-Cannon would shoot into the Town, it was so that we could scarce reach the Rampiers, then in hast we advised to reare or raise the Mount or Plat-form some 6 foot higher, and then we tryed the same again, and found the shot to out reach the other about 800 pace further into the Town, whereby it appeareth that by how much the Peece is heightned by so much further she will carry.

Gen. I confesse that the overseeer in this businesse may also be deceived in this thing, wherefore for my part, I think this thing more curious then profitable for the Warres.

DIAL. XI.

How we ought to lodge the Artillery to Batter a place.

Gen. THe affaires of the Warres are of so great weight, that we ought to be very carefull to husband the same, whereby we may see that so great batteries are to be made and procured, which ought to be very carefully performed, I pray you therefore give me directions what course I shall hold, in such sort that I may imploy all the Artillery to good effect?

Cap. This cannot be well resolved, except we know well the place and scituation of the thing to be battered, which is the principall thing to be considered in this businesse, for all the rest of the design consists in the scituation of the place.

Gen. I beleeve this well, yet notwithstanding, I know you have experience in this thing, and I do not doubt, but if you tell me a little, I shall the better understand what shall be requisit to be done in the rest?

Cap. One place may be easier taken then another, as thus, when

the aſſault ſhall be made on the one ſide, and the battery on the other, ſometimes on the Baſtions or Bulwarkes, ſometimes on the Curtaines neer adjoyning to the ſaid Bulwarks, ſo as we may attaine as much as is poſſible, to the end of the enterpriſe; which is the Victory, and the maſtery of the place to be battered.

But for my part, if I ſhould have occaſion to batter a great Town, and well peopled; I would think it better to batter the Curtaine, then the Baſtion or high Plat-form or mount, for moſt commonly in great places the Baſtions be well placed, lined and ſtrengthened one with an other, and the pane of the Curtain well flanked covered and defended.

Gen. Wherefore ſhould we more begin with the Curtains then the Baſtions?

Cap. Becauſe alwayes the Baſtions are more ſtrong and better provided with all neceſſary things then the Curtaines are, and the Baſtions are the chief force of the place, and better garniſhed and fortifyed with earth-workes and Walls, which will aſk more time, more coſt, and more paines then the Curtaines will doe.

Gen. But if the Souldiers that are not well practiced in ſuch Batteries, after they have taken paynes to batter the Curtain, ſhould give over or abandon their place, becauſe they are ingaged between two ſtrong Forts or Baſtions on both ſides, when they ſhould give the aſſault and reap the fruit of their labour and expence, then by that meanes they ſhall receive a ſtrong repulſe and let.

Cap. Good Sir, there can be nothing loſt by this courſe, for they may afterwards batter the Baſtion, and then if they will force the breach, we ſhall find the Enemy intrenched within, in ſuch ſort, that without the loſſe of time, we ought to begin a new battery; provided that the place be known, and the deſign and manner of the taking of the ſame, as well on the one ſide as the other.

Gen. Have you noted ſuch occurrents in other the like places?

Cap. Yes my Lord: in the Townes of *Grave* and *Tremont*, where we battered the Baſtions, I was in *France* alſo, at the taking in of the Town of *Corte*, where firſt we battered the Baſtion point and then the Curtain, and there was a ſtrong great Tower, but it did them little pleaſure, in ſuch ſort, that we were conſtrained to leave the battery on that ſide by meanes of the ſaid Tower, and make a new battery upon the Curtain on the other ſide towards the Field,

where

where for their defence, which did endammage us more then the Tower, we found a ſtrong Baſtion or Bulwark, but we got it at laſt.

I was alſo at the Town of *Cambray*, which was battered and won by the battering of the Curtain, and notwithſtanding the good and ſtrong Baſtions and Bulwarkes; and therefore, I anſwer you there is no ſuch feare to be had of ſuch Baſtions, but it bringeth ſuch commodity that one may ſee and eſpy ſome other way more fit either one way or other.

Gen. You ſpeak of great Townes, but ſay we have occaſion to batter a Caſtle or Fort or the like; how ſhall we take it to the moſt advantage?

Cap. When they be Forts or Caſtles whatſoever they be, then it is better to beat the high mounts and Bulwarkes, then the Curtains, for although the Baſtions be more ſtrong and more cloſe, that they be hard to be taken; yet if we ſhall beat a breach in the Curtain, theſe flankers will be ſo forcible if they be not taken away, that it will be a dangerous thing to enter the breach in the Curtain.

Gen. If we were to batter a Curtain or a Town, how many Peeces ſhall we uſe and of what ſort, and how ſhall they be divided and placed?

Cap. For this effect we ought to have 18 Peeces. *viz.* 8 Cannons, 6 Demi-Cannons, and 4 quarters or Field-peeces, being Demi-Culverings.

Gen. Why do you appoint more Cannons then you doe Demi-Cannons?

Cap. For the well and ſuddain battering of the place being fortifyed with earth-workes and Walls, it is more ſure to batter with Cannon then with any other Peeces, and they ſhall beat a breach more ſuddainly and more ſufficient, theſe ſaid Cannons being invented to no other end then to beat ruin and overthrow all things that ſhall reſiſt them or ſtand in their way, by meanes of their great force and fury.

Gen. And what diſtance ſhall we keep from the place to be battered?

Cap. We ought to approach as neere to the place as we can poſſible, but ſometimes we take 200 and ſometimes 300 paces; but it is the opinion of many good ſouldiers, to advance as neere as poſſi-

ble, even to the very Rampiers and Ditches, if we may be well covered and defended; not only to batter with more ſtrong force, but alſo to hinder and impeach the ſallies of the aſſieged, and the better to diſcover the Artilleries force and ſtrength of the Enemy, and other ſuch like things, which a man may perceive of himſelf.

Gen. I do well approve of this courſe, but I can ſcarce beleeve that you will bring this thing to paſſe very eaſily, to approach ſo neere, for the wages or pay that is ordinarily allowed to ſouldiers in theſe times, eſpecially if the aſſieged be carefull in their defence.

Cap. It is ſome danger, but not ſo much as you think, but thoſe that uſe the trade of the Warres, muſt accuſtome themſelves to all times and places, none exempt. But this danger is not ſo great, chiefly if we conſider the place to be equall with the earth and no great height, and that there be earth ſufficient for the workes and Covertures, yea and their Ditches themſelves, may ſometimes be an advantage to us, forasmuch as they are higher then the earth, they may enſconce and defend us, as the aſſiegeants ſhall be in leſſe feare, then if they were 2 or 300 paces diſtant.

Gen. How ought we to diſtribute theſe Peeces?

Cap. The 8 Cannons ought to make one Camrad or battery in a right angle againſt the Curtain to be battered, the 6 Demi-Cannons ought to make 2 Camrades, 3 on the one ſide, and 3 on the other, to batter in Traverſe, the other 4 quarters to make the defences, as it is ſet forth in the figure, in the which you may perceive the Baſtions ſhewing their Peeces, and the 2 Camrads ſhewing upon the 2 ſides how they batter in a ſlope line or *Hipotennſall.*

Gen. Good Captain, tell me how many ſhot may a man make in an houre in one Peece, and how many may be made in theſe Peeces in ten houres, and how much Powder will be requiſit for theſe Peeces?

Cap. In ten houres, theſe Peeces may well make 1440 ſhot, that is to ſay the Cannons 640, the Demies 480, the quarters Demi-Cannon 320, and for this we ought to have in Powder 5448. l. which makes 120 barrels, according to 160. l. to a barrel.

Gen. You count not then 80 ſhot to a Peece, which is 8 ſhot in an houre for every Peece?

Cap. One may well make 10 ſhot in an houre, if the Peeces be well fortifyed and ſtrong, but if they be but ordinary Peeces, or leſſe

leſſe then ordinary, then 8 is enough, alwayes provided that after 40 ſhot you refreſh and coole the Peece, and let her reſt an houre, for feare leaſt 80 ſhot ſhall break the Peece, being not able to indure the force and heat.

Gen. It ſeemeth to me that 8 ſhot is as much as moſt commonly may be made at a time, and in that ſpace of time, may be made in one Peece 130, nevertheleſſe I deſire to underſtand what experience you have had in this thing?

Cap. I remember that *W. S.* when he came into the Ile of *Bomell*, there was a Peece lodged in a Mill, that did ſo vex and torment the Enemy, that they were forced to lodge two Peeces about 100 paces off the one a Cannon, and one Demi-Cannon, to diſmount this Peece, theſe Peeces playd 4 houres, *viz.* From morning to eleven a clock, and they refreſhed the Peece 2 houres, and returned to their ſhooting again from one to foure a clock in the afternoone, at which time they were fain to ceaſe, becauſe the Peece could not indure the force and heat of her charge, and notwithſtanding this ceaſing, the other part by the command of *Don Lewis de Valaſco*, he cauſed an other Peece to be lodged on the other ſide in Traverſe of the other two Peeces of the Enemies, and diſlodged them in an houre.

There was a diligent ſouldier, that ſcored upon a tally all the ſhot that were made on our ſide from morning till 4 a clock at night, and ſhewed that we had made 80 ſhot, now ſubſtracting the 2 houres for refreſhing, amounteth to 8 ſhot in an houre, which is the moſt that can be made.

DIAL. XII.

How we ſhall defend a Town beſieged, and what Proviſion of Munition is neceſſary for the ſame.

Gen. NOw theſe carefull times, it is good to conſider of other things, I pray you tell me how we ſhall perform the buſineſſe of the Artillery in caſe we were in doubt to be beſieged in a Town, how we may defend the ſame in a long ſiege without any help or ſuccour from any other?

Cap. Such a Town ought not onely to de provided of Munition

but alſo of Victualls ſufficient, without the which, Munition will profit nothing?

Gen. After we have underſtood the Munitions, and what places ought to be guarded with the ſame, and fortifyed with Artillery, the one and the other, for 6 moneths entire; which is the moſt time that men may continue in a place that cannot be relieved, and we muſt regard the Victuall according to the number of men or beaſts that we will nouriſh?

Cap. For the Munition ſo much of that as doth belong to the ſervice of the Artillery, and the places that we will fortify or garniſh with the ſame, of the which we can make no preciſe account of ſuch things as are requiſit and needfull to be provided in every thing, for every day bringeth a new neceſſity, and alſo the Enemy will cauſe new offences; and therefore we muſt make new defences and workes within, with great prudence and diligence, and therefore we will ſpeak of thoſe things that are moſt neceſſary.

And firſt we ought to have 60 Peeces of Artillery at the leaſt, *viz.* 12 Cannons ſhooting 40 l. of Iron, to remove the defences and the Trenches of the Enemy, or for a Counter-battery to diſmount the Artillery of the ſame.

Item, 18 Demi-Cannons ſhooting 24 l. weight of Iron, for the ſame effect; and theſe Peeces are more light and handleable by meanes of the ſuddainneſſe and quickneſſe, which is a principall point in this affayre to get the hand of the Enemies Gunners, and to be quicker then they with their Peeces, again to conſider that when Warres are but of ſmall importance, alwayes to provide the leſſe Munition, a point alſo in a ſiege to be greatly and diligently conſidered.

Then 10 quarter Cannons, which ſome call Demi-Culverings, ſhooting 10 l. weight of Ball a peece, which by their continuall play or ſhooting ſhall annoy and hinder the Enemy in the enterpriſe, and offend the Sentinels and watches that ſhall enter and reſort into their Trenches, and finally to impeach and hinder the too bold and hardy approaches of the Enemy to the Ditches and Walls, of the Town by their Traverſes, for theſe Peeces are more quickly handled, and are more light and nimble, and may oftner and ſooner be tranſported from place to place, yea even unto the ports to hinder and Raſe the Enemies workes.

Finally

Finally 20 ſmall Field-Peeces, which we call Sakers carrying 5.l. weight of Iron, or 7.l. weight of Lead, and theſe Peeces being alſo moſt neceſſary and nimble, being and ſerving not onely upon the Rampiers and Murrals; but alſo in the breaches that the Enemy ſhall make.

Beſide ſtheſe ſaid Peeces, we ought to provide 3 great morter-Peeces, as well to ſhoot all ſorts of Artificiall fire-workes againſt the Enemy, as alſo to give light in the night to diſcover the Field, and know the Enemies workes in the ſame, to ſee the good time to meet with the ſame upon all occaſions.

Moreover we ought to have 400 Muſquetrous of Braſſe, which ſome call Hargubus or Crock, ſhooting 4 or 6 ounces of Iron, or 6 9 ounces of Lead with ſo much fine Powder.

Now the Gunners ought to take great heed, that they diſcerne the Cannon Powder from the fine, for they may commit much errour by this meanes, and endammage themſelves; but let them alwayes regard the uſuall proportion as well of the one as the other, & it is a meanes to ſave charge, for peradventure they may uſe fine Powder when courſe Powder may as well ſerve; and therefore, they ought diligently to regard their uſuall proportion.

Item, 200 common Muskets with their appurtinances, as Bandileers, reſts and moulds.

Item, Shot for every Cannon 500, the 13 Cannons 6000.

Item. Demi-Cannon ſhot for every Peece 1000, and for the 18 Peeces 18000.

Item. For every other leſſer Peece 5000 ſhot, according to the diverſity of their Calibers.

Item. We ought to make proviſion for 1500 Granadoes or fire-balls of a great bigneſſe to ſhoot in the Morter-Peeces when occaſion ſhall ſerve.

Item. Two thouſand more of ſmall Granadoes to caſt with the hand againſt the Enemy, when he ſhall make his approaches to force or enter the breach.

Item. A good quantity of ſmall pible-ſtones, burrs, ſpikes and other ſuch like matters to charge and load the great Peeces, when he ſhall, that is to ſay the Enemy ſhall enter the breach to winne the Town.

Item. All thoſe things that ſhall belong to the ſervice of the Artillery

Artillery, as Ladles to charge the Peeces, Spunges, covers of Lead for the Peeces, Coynes, Levers, and also spare Wheeles, Extres, Avantrins, Crowes of Iron, Sledges, Ginnes, and other such needfull things for the easie mounting and handling of the weighty Peeces, making alwayes double provision, to the end we fayle no whit in one or other thing.

Item. A good quantity of large Planks of Oake or of Chesnut-trees, for the making of the Platformes; also 20 Cressets flaved, also Pitch, Rosin, Tow, Ocam and other things ought to be in a readinesse, for the making of Artificiall fire-workes.

Item. A thousand long scaling Ladders, a thousand Hooks or Grapples, as well long as short, leather skinnes and tand hides, and other apresls to quench the fire which the Enemy shall shoot into the Town, and to avoid disorder, there ought to be certain men appointed to be ready at all times to quench the force of the fire, and with raw hides or such like, to stop the fire balls that the Enemy shall shoot into the Town, also a thousand Hargubuses with their moulds and flaskes, also a hundred Habergions, with their mancicples and Gauntlets, to cover as well the Armes as the Thighes.

Item. A thousand Pykes, and certain Caraces, also 15 good Targets, also six thousand quintax of good Powder, and also 3000 hundred of good Match, and 25000 hundred of Lead, also 4000 shod shovels, 2000 Mattocks, 1000 Spades, 3000 small Baskets, a good quantity of Sack-cloth for Bags to carry Earth, 1000 Beetles, 150 Carts or Barrowes for a horse a peece, and many such things for the repairing the earth works, and for the repairing the Trenches.

Item. A good quantity of Iron for the repairing of any thing that is broken, or to forge new, any thing belonging to the Artill.

Item. A good quantity of Galtrops. *Item.* 15000 Gabions, 200000 faggots, and great and small Trees to furre and hold up the Mines, 1500 of Planks of Pyne or Deale-boards, as well for the Mynes, as to furre and hold up the same.

Item. There ought to be two Powder makers, as well to refine the decayed Powder, as also to make new Powder; also 2 Salt-peter men, also a thousand hundred of salt-peter, 250 hundred of Sulpher, 250 hundred of Willow or Hasell cole, to make and refine the Powder, and to make artificiall fire-workes, also 1500 load of Char-

Char-cole, as well for the ordinary fires as for the Kitchin, to the end the Enemy ſhould not perceive the ſmoak and ſo endammage the place.

Item, 1000 load of Hay and Straw, as well to forrage the beaſts as to make wads for the Artillery.

Gen. Mr. Captaine, I ſee that when you make mention of the Cannons, that you make no account as I have known in times paſt of whole Culverings, I pray you ſhew me your reaſon for it?

Cap. In times paſt they made ſmall account either of Cannons or Culvering, except it were in a Citadell of great force and ſtrength belonging to a ſtrong Town, which Citadell did command the Town, and keep the inhabitants in awe and obedience, then theſe great Peeces as well as the ſmall are of ſingular effect, as well to humble and bring down the proud ſtrength, and to make them tremble; but as for Culverings, whereas you ſay I have omitted them as unprofitable, ſo I think them to be exeept it be in Ports and Towns neere upon the Sea-Coaſt, becauſe they will carry farther, and offend the enemy at a greater diſtance then any other Peece; and therefore more fit to offend a Fort that is like to be approached by the Enemy, or to defend and ſafe-guard the Ships and Veſſells that paſſe too and fro with Marchandiſe or Victuals, or ſuch like, in which places the Cannons are not ſo ſerviceable or ſo fit; alſo by reaſon of their great weight, are not ſo eaſily handled without ſtore of men, alſo the ſmoake or ſmother is much offenſive and the grief of the inhabitants, becauſe of the great coſt & charge; and therefore theſe great Peeces ought not to freely (or in a battery at the beginning) for feare of want of Powder, and Munition in the end, by ſpending at the firſt more then needs.

As it fell out with them of *Amiens*, which being beſieged by King *Henry* the fourth, they defended themſelves ſo brave and gallantly at the firſt with their Cannon, and ſpent more Powder then their needed, they were at the laſt conſtrayned to yeild up the Town for want of Powder and Munition.

The ſame alſo ſuddainly fell out in *Anno* 1606 at *Rineberke*, when the Enemy ſerved with their great Peeces, till they had ſpent all their Powder; and in the end found themſelves unprovided, to their great loſſe and dammage; And therefore I adviſe, that a Town or place be not charged with ſuch great Peeces, except they

well aſſured to have more then enough of Munition, and ſo well provided that they need feare no want, which is a hard matter to doe; and therefore it is good to avoid the danger which may befall in this thing.

Gen. This is a reaſonable anſwer, and herein I hold my ſelf well ſatisfyed; But ſay the Enemy ſhould make a battery, and that we be forced to make a Counter-battery, and for the ſame to remove or withdraw ſo much Artillery as is fit for the deſign, ſurely I think this Counter-battery will be to ſmall effect if it be not well fortified with the Cannon?

Cap. The Demi-Cannons are moſt proper for this effect as experience aſſureth me, in the ſervice that I have ſeene, that Demi-Cannons are farre better in a Town then the Cannons; and for as much as we muſt have, or place Peece againſt Peece; I ſay that the Cannons ſhall be no better then the Demi-Cannons, except the defence that will be more againſt the Cannon then the Demi-Cannon; but in making a Counter-battery, we alwayes take Demi-Cannon rather then the whole Cannon, firſt becauſe they are more light and more eaſie to handle then the Cannon, and ſooner by the Gunners brought to their mark, then the Cannons of the Enemy which are more weighty, and this is a thing moſt carefully to be regarded in theſe and the like affaires; that we may endeavour by all meanes poſſible to be quicker with our Ordnance then they, for thereby if we take heed we may mouth their Peece or diſmount her, or do ſome great harme, if we fire juſt when their Peece is bringing forward or laying to the mark.

And although it be true that the Peeces of the aſſiegeants are more proper to review and overthrow Walls, and Rampiers, which for the capacity of the place coſtomarily, made in ſmall Townes and Caſtles; then we muſt needs be in continuall danger of theſe great Peeces; that overthrow our workes or diſmount our Ordnance, for it is a certain thing that in a Town or Fort they make no ſuch reckoning, neither can they; but that the Enemy may indanger them, and therefore are liable to dammage.

As in the 8 Dialogue may be ſeene, and therefore the prudent and well governed men in the Field, are like to have beſt ſucceſſe, and briefly, even as the Cannon in this caſe is of little uſe, ſo are Culverings of farre leſſe, except they are lodged upon high Mounts

or

or Plat-formes, where one would attend the canning of the Enemy upon his quarter and ſo to annoy him a farre off, before he can make his battery or find any ſuccour; but if the battery be once made, the Culvering is of no great effect nor cannot be uſed without much danger.

Gen. Then you maintain the Culvering to be more painfull and dangerous then the Cannon?

Cap. I dare ſay it is: Firſt in that his high mounting and the length of his neck, which he ſhall alwayes ſhew more then is needfull, ſhall alwayes be diſcovered by the Artillery of the Enemy, and after he is diſcharged, may ſtrike upon the Counter-Barb of his Carriage, and then not only his Carriage will be in danger, but alſo he will not recoyle ſo farre as he ſhould, & ſo may ſtay in the Troiſner, and by that meanes the poore Gunner when he ſhall come to lodge her again ſhall be in great danger of being diſcovered, and hazard of his life; and all this in the ſight of the Enemy. See here the difference between the Cannon and Culvering, and the reaſons that I have ſhewed in that behalf.

Gen. You have well ſatisfyed me in this my opinion, and informed me in the courſe that I meane to keep hereafter in the like occaſion, not onely in this, but alſo in the Powder, leaſt we ſhould demand too much.

Cap. I aſſure you my Lord again, that we ought alwayes to provide enough, but not much more then is ſufficient to ſerve our turn for our good and ſure defence.

Gen. Now during the Siege, I pray you ſhew me your opinion whether we were better imploy more of our Powder in the Artillery or in the fire-workes?

Cap. I can ſcarce determine this point; but I councell the aſſieges that they imploy moſt of their men in the Hargubuſhy, and the Muſquetery rather then in the Artillery, but when the aſſiegeants cannot after the battery of Walls reſiſt their deſign, which is to preſſe the beſieged on all ſides, and to remove all the defences and repayres, or at leaſt to keep them from renewing their workes and covering their Trenches again; I hold it more advantagious to imploy the Artillery, for ſo much as it may be accompliſhed with more eaſe, and if the aſſieges will ſerve with the Artillery, I hold it beſt that we uſe thoſe that are of the ſmalleſt Caliber, and that de-

mandeth leſſe proviſion, yet alwayes ſufficient for ſuch a defence, for which cauſe I have appointed more Balls for the Artillery to ſerve ordinarily, that by that meanes the greater might be ſpared for greater affaires; in conſideration that one may make 4 ſhot in a ſmall Peece that is well lodged, that ſhall do more hurt to the Enemy then a Cannon that at one ſhoot ſhall require or ſpend as much or more Powder.

Gen. Which is it that doth moſt hurt at a Siege, the ſmall ſhot, or the Artillery?

Cap. The hurt that is done by the Artillery is very great, and is a great feare to the Enemy more then the ſmall ſhot, in ſo much as a good ſouldier, if he be not utterly loſt, doth eſteem the ſmall ſhot but as the play of children in compariſon of the great ſhot.

Gen. And which think you do ſpend moſt of Munition, the ſiegers or the beſieged?

Cap. This you may well ſee, that on the part that doe beſiege there is a greater company of men; and therefore alſo muſt needs ſpend more, and the aſſiegeants to bring to paſſe their deſigne, are more free and liberall, and alſo they have the commodity of their liberty to provide all things neceſſary; and do injoy more abundance then the beſieged can, which alwayes have an apprehenſion of want, and feare ſcarcity; and therefore, do not ſpend ſo much Munition or Victuals as the beſiegers do.

Gen. In your account you make mention of two great Morter-Peeces; I pray you ſhew what ſervice they may do at a Siege?

Cap. Truly theſe are not to be forgotten nor neglected in this place, conſidering the great ſervice that may be performed by them how they play their balls, high and low, and the great force that conſiſts in theſe things; how we may play into the Trenches as well farre off as neere, and in the time of the aſſault one may cauſe the fire-balls to fall amongſt the Enemies, being alſo armed and ſeconded with Muſket ſhot, which with thoſe balls and other matters inextinguible, ſhall preſſe and vex the Enemy moſt grievouſly.

Gen. And what is the uſe of the Muſquetroons of Braſſe, or thoſe that you call Hargubus a Crock?

Cap. Theſe are to be diſperſed equally into divers quarters, that where the Enemy ſhall make his approaches, they may ſo hinder

him

him that he cannot cover his blinds and Gabions, and alſo they are a great ſparing to Powder.

Gen. I confeſſe you have made this account well and with good conſideration, notwithſtanding, there yet remaines three things wherein J deſire to be ſatisfied; the firſt is the uſage of the faggots and Gabions, the ſecond is the effect of the double Curaces, the third is the lodging, that is the moſt commodious place of lodging to offend the Enemy, and of leaſt danger to our ſelves?

Cap. Touching the firſt, J can aſſure you that the Gabions and all the Faggots and Rampiers are the moſt principall things for the eaſing of the beſieged, for fault whereof, they fall into moſt great trouble and perplexity, as often times I have had experience in theſe things; which being neglected and wanting, we have often-times been forced to ſurrender the place eſpecially for want of faggots, for it is a hard matter to make defences alone of earth without faggots which ought to be enterlaced or mingled with the earth, and when we are to make Plat-formes in haſt, we cannot be without them; theſe muſt alſo ſerve to make half-Moones, and to be brief, fault of faggots, fault of defences, the Gabions ſerve not onely to cover the Traverſes, but alſo to break the Enemies ſhot, which being pitched in divers places, in ſuch ſort, that he ſhall not well endammage any place with his Artillery, by reaſon of the Gabions.

Gen. I did not think that theſe things had been of ſuch uſe and conſequence; but I perceive by you that they are not onely fit for ſuch publique ſervice, but alſo I ſee they may ſerve for other private uſes about ones houſe, and for every family, for which we are bound to provide of theſe things a certain quantity, which in caſe of great neceſſity may be uſed in the cauſe of fortifications, now tell me the thing concerning the lodging of the Peeces?

Cap. Of this cannot much be ſaid, before we ſee the ſcituation of the place, and that the firſt aſſault be given; but to the end we ſhould prevent all danger, it is ſo that if he will ſet upon the Curtain to take it, then we muſt lodge our Peeces upon the Baſtions that are moſt neere; and alſo place two Peeces more behind them inward from the ditch, and theſe ſhall flank the ditches or breach, giving charge that no Peeces, either from the Baſtion or the ditch, ſhall play untill ſuch time that the Enemy ſhal preſent himſelf with all his force to enter the breach, and then at an inſtant of the great

fray and hurle of the Enemy to discharge the Ordnance.

But if he will attach the Bastion, we ought to intrench at the neck noted with *A*. and in this intrenchment to lodge certain Peeces well covered with Espauls, and keep these secret till the time that the Enemy shall think to gain the Town, and is entred within the Bastion; then discover the Peeces and discharge them suddainly, and this will beat them back in a moment.

Gen. And ought we to do this as well in the Curtain as in the Bastion?

Cap. Yes principally in such places where the houses and buildings are a good distance from it, that we may take roome enough to make a half-Moon or other necessary intrenchment, otherwise we must take away the houses and those buildings that hinder the work, and notwithstanding the Enemy should beat a very great breach and the entrance very large, the retrenchment then will be more hard to make and more hard to keep, and more painfull; because they of the Bastion are so opposite against them, that they may both keep and defend themselves with fewer men; but sure it is a hard thing to conclude of any matter certain in this case, except we know the commodity or incommodity thereof; we cannot resolve or give a perfect determination what is to be done best, but must of necessity leave this to the diligent and industrious, to chose the most fit and convenient wayes.

Gen. It is a Proverb, the Marck shewes the Price and necessity resolves the doubt; notwithstanding, it is no bad thing for a man alwayes to have intelligence, to the end he may the better ground his businesse in these affaires in which I take great pleasure in your advice: now I pray you shew me the use of the third thing, what is the use of the double Curaces and the Targets?

Cap. The Targets are of singular effect in a sally, to cover not onely those that carry them, but also those that follow them against the small shot, as also at the entrance of a breach, placing certain men that are covered with these Targets, and a good Cutlas in their hand, they may withstand the Enemy a long time. the same is also to be understood of the Curaces, and also of the arming of their Armes and legs is a sure thing, and makes them more hardy and courageous in their defence; and therefore *V.S.* thought these things of no small consequence, and are of such esteem, as in my opinion

opinion all townes, eſpecially thoſe upon the Frontiers of the Coaſt ought to be well furniſhed with the ſame, alſo they will ſerve to defend thoſe that are forced to Scale the Walls, and ſuch like.

And thus you ſee not onely my account of the charge, but alſo the reaſons of the ſame according to my experience.

DIAL. XIII.

How the Generall of the Artillery ſhall govern himſelf when he doth beſiege a Place.

Gen. MOunſieur Captain, now I have ſeen your diſcourſe in generall in the defence of a Town beſieged, let us ſee now the particular duty or bond of the Generall of the Artillery when he is to beſiege any Place?

Cap. There is no great neceſſity whether a man ſhall be prepared a long time before or a ſhort time, but taking occaſion of the firſt ſubject, or the thing he ought to avoid in every Siege.

In good time when the aſſiſtance or advice of the Governour of the place; or the aſſiſtance of the Maſter of the Hoſtile, which is charged with the Munitions, that then he doth viſite the Magazins and Arſenalls of the ſame, what Munitions are in the ſame and how long they will indure, and if their be any fault, to repayre the ſame in time, and in particular as much as concernes the Artillery, to ſee the ſame proved with great care and diligence, and to Caliber and fit all the ſhot, and ſort them every one apart in ſeverall heapes by themſelves apart to avoid confuſion, allowing for every Peece of battery at leaſt 1000 balls, and for the Demi-Cannon at leaſt 500, and not forgetting the Powder to cauſe certain barrels to be brought forth and to ſee it be well conditioned, open the heads and thruſt down your hand even to the bottom, and regard the Regiſters of the Maſter of the Hoſtile, what ſtore he hath in his Magazines and Cellers, and ſee that he have a 1000 hundred of fine Powder for the Artillery, and 1000 hundred for the ſmall ſhot, and the Mines, and the Artificiall fire-workes, ſummarily to provide all thoſe things provided in our former account, that they may be ready at an inſtant, giving advertiſement of all theſe things to the Governour or chief Generall of all theſe things requiſit for this ſervice,

vice, to the end he may give order to ſupply the defects, and by this meanes he ſhall acquit himſelf of all ſuſpition of negligence.

Gen. This in my opinion concerneth chiefly the Governour, upon whom dependeth all the guiding and ordering of all ſuch things which belong to his place?

Cap. This is true, yet notwithſtanding the Generall of the Artillery is to ſee this effected which effect is chiefly recommended to him; becauſe the Governour hath many other cares and imployments, in divers affaires; but it is the duty and Office of the Generall of the Artillery to provide with all diligence thoſe things that are fit for the ſervice of the place, and in this let him be governed by the precedent account, and the following inſtruction.

Firſt, before he doth preſſe the Army of the Enemy, he ought to ſearch on which ſide he ſhall moſt endammage the Enemy, and where he ſhall lodge moſt conveniently his Peeces, that they be in moſt ſafety; and to provide Coverture, Eſpauls and Blinds ſufficient, and not to retire from the Walls till the Enemy be like to take his quarter, and to trace the Trenches, beginning to approach the Town or making his approaches thereto, and alſo not ceaſing to offend the Enemy in the meane time with all his power, and when the Enemy ſhall approach, to the end that he may remove the Artillery or the uſe thereof, that he then retire to his reſerves or places where he hath placed certain Peeces of Artillery in ſecret, which ought to be fitted and accommodated at the foot of the Murall in banks and Trenches in ſecret, before he be aware. Moreover if the Enemy leave or abandon the Wall to enter the ſame with all ſpeed poſſible, and when preſent occaſion ſhall ſerve, that he mount or place certain ſmall Peeces that he may turn into the Field it ſelf, or elſewhere, for it is a moſt certain thing that there are no Peeces more dangerous to anoy the Enemy then theſe, the uſe whereof we might well perceive at the Siege of *Oſtend*, and if we ſhould loſe certain Peeces, it were no ſuch great loſſe, as if for feare or cowardiſe one ſhall finally loſe the place and Peeces alſo, yea and their lives alſo with the ſame, in ſuch ſort that the Generall at that inſtant ſhall take councell and advice with the Governour and his Captaines how he may encounter the Enemy with like Peeces as well to recover themſelves, as to raſe and overthrow the Enemies workes, chiefly bending all their indeavour to cauſe them to loſe

ther

their boldneſſe and courage, and to hinder them from ranging and ſearching the Field.

And for this cauſe we ought to provide well, to make Galleries and coverts over the ditch, as well to cover the ſaid Peeces in the Field, as to encounter the Enemy in the Trenches.

Moreover, he ought to be carefull to lodge certain Peeces behind the wings of the Baſtions, and Caſamats, provided with good and ſound Cannoneeres, and that they make not their flanks more large then the bredth of the Ditch, to the end that the Enemy ſhall not diſcover from without how the Peeces are placed, and when they be placed; let them be charged with Burre, ſhot, ſpikes, chaines, and gobbits of Iron; to offend impeach and ſpoyle the Enemy when he ſhall force the breach.

Alſo it will be to great purpoſe, if within the Murrall you raiſe a Caviler or Rauling for the defence of thoſe that ſhall work in the Ditches, or pitch or ſet up the Bridges, theſe things ought alwayes ſo to be ordered, leaſt the Enemy ſhould diſcover the battery from without, and perceive the meanes of every thing that is done there and how it is ordered, and alwayes let the Peeces be lodged, that they may face the Peeces of the Enemy, and not be diſmounted at the time of the Siege.

During the aſſault, the Generall as he ſhall ſee occaſion, ſhall occupy thoſe Peeces that are lodged in ſecret in the ditch according as he ſhall ſee occaſion to attend the Enemy, and alſo the Artificiall fire-workes to be ready, and alwayes to take great regard that his friends that are imployed in the defence of the breach, be not indangered or annoyed, and chiefly that the Powder be well guarded and covered that it be not fired, that you loſe not al the proviſion in an houre, or at once; and if ſuch a chance ſhould happen, to give preſent order to have it preſently ſupplyed with new, and except his aſſiſtants be well bleſſed, will by that meanes be much hurt and diſcomforted, to the great joy and incouragement of the Enemy, as many times it falleth out.

In the skirmiſhes, to take great heed that the ſmall ſhot of the Enemy do not fall in or among the Artillery, and for this cauſe to prepare and have alwayes in a readineſſe two or three Peeces all ready when the other ſhall be diſcharged and when the Enemy ſhall offer to invade or force the Troiſners, that they reſiſt courageouſly,

although it be by meanes of the shot from the Bastions or higher Plat-formes, and be ready alwayes to lose their lives a thousand times, then it should be said that by their cowardise the Camp should be forced, and he ought at such times to see that they be supplyed with fresh forces, and that to that end he visit continually all the batteries, very diligently giving order that the Gentlemen and the Gunners may be well encouraged, and provided of all necessaries.

And also he shall take order that the labourers may work in secret and secure when they are to make or repayre the Troisnes, or heighten the Plat-formes in such sort that the Enemy may not perceive their work, and in the morning betimes shew their businesse by saluting the Enemy at first with their Cannon & as they say, beaforehand with them to dismount their ordnance, and although it be hard to do, yet let them not fayle to weary and torment the Enemies Gunners, that they may be alwayes busied in repayring their Covertures, and so also giving time to the besiegers to do the like.

In distributing the Munitions, we ought that there be great regard and discretion, to be liberall in the businesse according to the plenty or scarceneſſe of the place, releasing alwayes the play of the great Artillery, which ceasing for default of small shot, it is a certain thing that the Enemy will approach, and it is a great comfort for the Gunners, that there be lodged Hargubuses and Muskets in secret; and so we may hold out even to the last man.

Towards the Gunners and other Officers of the Trayn, he is to shew himself gentle and loving refreshing them not only with Victuals, but also rewarding them with certain presents in recompence of their paynes and labour.

When there is any work to be done outwardly, as the repayring the Espauls, Tenayles or other defences, it ought to be done by night and for that end he is to cause men to rest in the day time, that they may make their necessary works or strengths in the night, admonishing them to purge their consciences, and to fit themselves for God, in case they should be taken away by death at an instant, seeing that in the night the Enemy may in some sort discover them, being in most eminent danger, see here the Office of the Generall of the Artillery in these things, and how he may acquit himself with love and honour in his charge.

Gen. This diſcourſe doth give me ſingular content, and hereby I ſee it is a great charge and requireth great diligence and wiſdom, prudence and diſcretion, and to be vigilant to provide himſelf upon all occaſions.

The Concluſion.

There are many other wayes both for batteries and other ſtratagems practiced in the Warres, which I here omit, referring the reader to the book publiſhed by *Vſano* Captain of the Artillery in *Antwerp* Caſtle, being an excellent work; for my deſire is only to give inſtruction to ſuch Gunners as are new beginners in that Art, for whoſe ſakes I have taken this paine, beſeeching Almighty God to bleſſe this my labour that it may be profitable for my Country, and acceptable to the King my Maſter, and his moſt honourable houſe, the Lords and Commons in Parliament, humbly beſeeching God to bleſſe them all with the bleſſing of Peace and unity in this world, and in Heaven everlaſting happineſſe. *Amen.*

The Authors meaning is only to inſtruct Gunners and not meddle any further

Eſt aliquid prodire tenus,
Si non datur ultra,
Cum deſunt vires
Tamen eſt laudanda voluntas.

FINIS.

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FINIS.